



# **LONG-TERM MANAGEMENT OF THE ENVIRONMENTAL EFFECTS OF TAILINGS DAMS**

*Office of the*  
**PARLIAMENTARY COMMISSIONER FOR THE ENVIRONMENT**  
**Te Kaitiaki Taiao a Te Whare Paremata**



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**Te Kaitiaki Taiao a Te Whare Paremata**

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# PREFACE

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For many years New Zealand's mining legislation and minerals policies have promoted mining, a not surprising focus given the importance of mining to our past and ongoing economic development; however it has only been within the last 16 years that legislation and policies have enabled the effects of mining activities on the environment to be considered in the licensing process. In the current transitional provisions of the Crown Minerals Act, there are no provisions to ensure that long-term effects of existing tailings dams are effectively managed after the mining licence expires.

The issue of long-term management of environmental risks is primarily of interest to local government as 'guardians' of the sustainable management of our natural and physical resources, and assessors of environmental effects. Central government also has an interest in ensuring that tailings dam sites are properly rehabilitated and maintained by mining companies and successive land-owners. Sites abandoned before clean-up is completed may, by default, become the responsibility of the Crown.

The purpose of this study is to investigate these issues and to present options to central and local government and make recommendations for improving the long-term, post-closure management of tailings dams. It was initiated in direct response to a complaint about the long-term risks that tailings dams present to the environment. However, it also builds on a study by my predecessor: *Golden Cross Mining Project Environmental Impact Audit*, 1988.

Some modern mining and mineral recovery methods have increased the scale of mining operations which have resulted in an increase in the potential impacts on the environment in the locality of the mine and over time. A dam for impounding tailings has the potential to generate environmental and safety risks for many years, depending on the geology of where it is located, how it is designed and constructed, and the nature of the tailings it contains. Landfill and contaminated sites may generate similar concerns.

In this investigation I have decided to focus on tailings dams, but the lessons learnt could equally apply to any structure or facility that requires management to avoid adverse effects on the environment for many years after the associated activity has ceased. In many cases the probability of a potential adverse effect may be low, but the consequences of any potential impact may be extremely serious. Unpredictable events, such as earthquakes, may occur which increase the potential risk, and the performance of structures and other facilities under extreme conditions may be uncertain in the long term.

My team's investigations have revealed some serious deficiencies in current financial and legislative provisions for dealing with environmental effects that arise after a mine has been closed. The current mining licence bonds or financial deposit arrangement only covers the so-called "rehabilitation period" prior to mine closure. There are no funds for dealing with post closure needs. This situation stems from a major deficiency in the old Mining Act and in the transition arrangements of the Crown Minerals Act. Mining licence holders are not required to monitor, maintain or fund anything associated with their mining activities once the mine is declared closed. The risks and any burdens are borne by local communities, local and central government. That is clearly unacceptable and I have recommended legislative changes.

The challenge for the mining industry in New Zealand is to collectively raise the standards under which it operates. In Australia, for example, the industry has developed a Code for Environmental Management for its activities. The Australian mining industry has recognised the need to achieve environmental excellence and to be open and accountable to the community. The code sets a high standard which few, if any, companies could comply with immediately. However, it demonstrates a commitment to improving the industry's environmental performance. The NZ mining industry could benefit, in terms of maintaining competitive advantage in environmental management, by setting and working to achieve similar goals.

**Dr J Morgan Williams**  
**Parliamentary Commissioner for the Environment**

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# 1 INTRODUCTION

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This report examines the current system (legislation, policies and public authorities) for managing the long-term risks to the environment created by the impoundment of mine tailings within purpose-built dams. Its purpose is to draw attention to issues and options relating to managing adverse environmental effects long after the mining operation has ceased.

Tailings dams are located at four mining sites in New Zealand: two in the Hauraki district and one in the Matamata-Piako district of the North Island, and one in the Waitaki district of the South Island. They are all associated with current or former gold and silver mines licensed under the Mining Act 1971, or the 1926 Act in the case of Tui mine.

Tailings are fine-grained, particulate solids consisting of a slurry of ground-up rock, water and chemical residues that remain after the commercial minerals or elements have been removed from the ore. Tailings dams are structures built for the purpose of impounding this waste material. They are a twentieth-century invention and form an important part of modern mining practice. Their design and construction have advanced through improved understanding of soil mechanics and geotechnical and hydrological principles.

The potential for tailings from gold-mining operations to produce acids is a recognised risk of the processing of some gold-bearing rock. Depending on the geochemical nature of the rock, the fate of cyanide (used to recover the gold and silver from the ore) in the tailings and the structural stability of the dam, tailings dams remain a potential hazard to the environment in which they are located for many years after the mine closes. It may take tens of years after mine closure for the tailings to consolidate (compact and solidify). Acid mine drainage may occur, caused by oxidation of sulphide-bearing rock and enhanced by biological processes, and this may continue to adversely affect the environment for hundreds of years. Safety and surveillance of environmental effects of tailings disposal facilities and other sources of acid drainage are, therefore, important long-term considerations, and the long-term site management costs they may give rise to are uncertain.

In the past, when smaller-scale underground mining was a common practice, tailings were dumped into nearby rivers and streams. The Ohinemuri River in the Thames Valley, for example, was at one time designated as a sludge channel for this purpose. More recently technological developments have made it more economical to recover gold and silver from lower-grade ore by large-scale, open-pit mining, resulting in larger volumes of tailings being produced requiring the construction of purpose-built dams for their disposal. In general, open-pit mining is a productive yet intensive use of land, creating permanent

fixtures such as tailings dams, having the potential to contaminate land and water, and restricting future uses of the land. As an example of the scale of open-pit mining in New Zealand, one of the larger mines on average produces approximately 75,000 oz of gold and 650,000 oz of silver from 3.5 million tonnes of ore and waste rock mined from its open pit per annum (Martha Mine Information Guide, November 1996).

This investigation has been carried out under s 16(1)(a) of the Environment Act 1986 which, with the objective of maintaining and improving the quality of the environment, enables the Commissioner to review the system of agencies and processes established by the Government to manage the allocation, use and preservation of natural and physical resources.

## 1.1 Background and scope of the investigation

In 1996 the then Parliamentary Commissioner for the Environment decided to carry out an investigation into the management of activities regarded as being of high potential environmental risk. Following a complaint about the potential impacts of mine tailings dams on the environment, and after some initial discussions with various interested parties, the Commissioner decided to narrow the investigation to focus on the effects on the environment of tailings dams.

**This investigation is not intended to be a critical review of the technical information gathered on tailings dams for the purpose of obtaining consents, nor does it address the question of whether tailings dams *per se* are an appropriate means of disposing of mine tailings.** These are issues that need to be examined on a case-by-case basis as part of any resource consents application stage. This report studies obstacles to, and opportunities for, ensuring that the long-term responsibilities and liabilities for addressing any potential environmental risks from existing and future tailings dams are clear.

The issue of the legal responsibilities for long-term management of tailings impoundments is not a new one. The Commissioner raised the same issue in the Environmental Impact Audit of the Golden Cross mining project in 1988, the Audit of the Martha Hill mining project in 1986, and in the Audit of the Spectrum Resources Ltd proposals for the Monowai-Maraetoto mines:

*‘Responsibility for long term maintenance and damage repair, following expiry of water rights, is not prescribed by law ... [a]rrangements for long term responsibility ... are unclear. Tailings dams and some waste rock stacks will require careful management into the 21st century and beyond. ...*

*I consider there is an urgent need to establish, in law, responsibility for dam safety, bonding/trust fund arrangements beyond the life of a project, and a special fund to cover management of environmental hazards in perpetuity.’*  
(PCE, 1988, preface)

Between then and now, however, the issues associated with long-term management have not been addressed by government when making changes to the minerals allocation regime or to environmental management legislation. None of the mining operations involving tailings dams has yet reached the closure stage (with the exception of the Tui mine), but the first such closure is expected in 1998 with more to follow over the next 20 years.

Draft terms of reference for the investigation were circulated to a number of interested parties for comment and, where appropriate, the terms of reference were amended to take these opinions into account. This was followed by discussions between the investigating team and individuals, groups, mining companies, and central and local government agencies with an interest in the management of mines and the environmental effects of tailings dams. Visits were made to the sites of three of the four tailings dams in New Zealand. Information on issues related to the long-term management of tailings dams was obtained from sources in New Zealand and overseas. The Commissioner also contracted the services of a consultant geotechnical engineer and a legal adviser to assist the investigating team in the preparation of this report.

An earlier draft of the report was circulated for comment to parties who were consulted during the investigation and, where possible, their views have been incorporated into this version. The draft was also reviewed by three external peer reviewers.

The objective of the investigation was to review and assess systems for managing the long-term risks to the environment associated with existing mine tailings dams in New Zealand. To achieve this objective, the terms of reference were:

- 1 To examine the current practices, methods and requirements for managing the long-term risks to the environment associated with tailings dams.
- 2 To identify and examine the roles, responsibilities and liabilities of public authorities involved in the environmental management of tailings dams, drawing attention to any deficiencies and good practices within and between public authorities (including issues relating to Ministerial responsibilities, central and local government functions, availability of expertise, etc.).
- 3 To identify and examine the responsibilities and liabilities of owners and/or occupiers of land on which tailings dams are located.

## **1.2 Methodology**

## **1.3 Terms of reference**

- 4 To review current and proposed legislation, and associated statutory processes, governing the management of tailings dams and to draw attention to any gaps, deficiencies or areas requiring clarification.
- 5 To identify any other constraints (eg, incomplete information, cost of remediation, monitoring and maintenance, unclear responsibility/liability) to achieving an effective system for the long-term management of tailings dams.
- 6 To identify current and potential financial instruments and incentives intended to limit long-term public liability for managing the environmental effects of tailings dams.
- 7 To report on the outcome of the investigation to the House of Representatives and to advise on any remedial action the Commissioner considers desirable.

## **1.4 Comments on the scope of the investigation**

During the course of preparing the terms of reference for this investigation, a number of questions were raised by interested parties about the scope of the study. It was suggested that it should also examine the safety and environmental effects of conventional water storage dams, landfill sites and contaminated sites. The reasons, other than time and resource constraints, for not broadening the scope to include these other matters are outlined below.

### **Tailings v conventional water storage dams**

Tailings dam design differs from that of conventional water storage dams in several ways, including (Klohn, 1995):

- Unlike a water storage dam, the potentially contaminated fluids and solids in a tailings dam cannot be released at the end of the dam's useful service or if a weakness or failure of the dam structure is discovered. In some cases the level of toxicity of tailings, depending on their geochemical nature, may remain high for hundreds of years.

- The bulk of material stored behind the dam is soft, loose, relatively impervious tailings, the consistency of which may range between solid and semi-fluid states. Under severe seismic shock all saturated tailings are likely to liquefy, becoming a fluid of high unit weight and placing additional loading on the dam.
- Because tailings dams usually are constructed slowly over a period of many years, the designer is able to select a design and monitor its performance, making modifications as required throughout the long construction period. This allows more flexibility than is available for the design of conventional water retention dams, enabling the operator to remedy any unforeseen structural problems. However, having such flexibility does not mean that consent applicants should disregard safety standards, or that they need not carry out an assessment of environmental effects of a proposed structure.

### **Tailings dams v landfill sites**

Tailings dams and landfill sites share many common characteristics. Both require careful design, construction and management at the operational phase to reduce risk and aid the management of the sites during the post-closure, long-term phase. Each produces leachate which has the potential to contaminate surface water, groundwater and land unless it is properly drained and treated. Tailings dams contain non-degradable material of a known quantity, and of a chemical quality that varies over time. Landfill sites consist of a mix of hazardous and non-hazardous, degradable and non-degradable material which is not usually impounded within a dam structure, but may be built up in embankments above ground level. Some of the material contained within a landfill, like the tailings in an impoundment, may be a source of potential environmental contamination for many years, whereas other material (eg, organic waste) decomposes and becomes harmless.

The criteria for selecting sites differ between tailings dams and landfill sites. Tailings dams are generally located as near as possible to the ore body for practical and economic reasons, whereas landfill sites can be located in any suitable site, but are usually isolated from densely populated areas.

One of the physical differences of tailings dams relative to landfill sites is that, during the period when tailings remain in a semi-fluid state, a breach of the dam could result in the release of a large volume of tailings slurry downstream. This risk is likely to reduce over time as tailings consolidate. The issue of possible catastrophic failure as a result of dam break or embankment collapse scarcely arises with landfills, as in them the rubbish is largely self-supporting and does not have the potential to liquefy. Leachate and gas generation in a landfill are likely to peak at about closure time, and then to steadily decline. With mine tailings disposal facilities, there is likely to be a decline in hazard level immediately after closure because cyanide ceases to be added to the waste stream and any cyanide residues in the tailings

decay. Provided the tailings disposal facility has been designed, constructed and maintained to protect potentially acid-producing materials from exposure to air and rainfall, the long-term risk is unlikely to vary much over time.

Both mining companies (in the case of tailings dams) and local authorities (in the case of landfill sites) remain responsible for managing any adverse environmental effects for as long as they own or operate the site. Public ownership of landfill sites is less likely to change than private ownership of mine sites. In either case, any change of ownership of the land will transfer the long-term risks and costs to the new owner or, in the case of 'orphan' sites which have been abandoned by the owner, to the Crown by default.

The importance of long-term, post-closure risk management applies to tailings dams, landfill sites and other activities that potentially leave a legacy of environmental effects.

### **Tailings dams as contaminated sites/hazardous waste facilities**

A tailings disposal facility could fall within the definition of a contaminated site according to the Australian and New Zealand Environment and Conservation Council (ANZECC) definition (MfE, 1995, p.1):

*A site at which hazardous substances occur at concentrations above background levels and where assessment indicates it poses, or is likely to pose, an immediate or long-term hazard to human health or the environment.*

Similarly it may be regarded as a hazardous waste storage facility since the dam impounds residue from the processing of ore that may contain hazardous substances at concentrations above background levels, or substances that may become hazardous if they are allowed to oxidise.

In the absence of any other suitable option for disposing of tailings, the contaminants and potentially acid-producing materials they consist of have to be securely impounded in perpetuity. As such they may be regarded as contaminated sites, and subject to any restrictions on future use outlined in the relevant regional or district plan.

## 2 MINING – THE LEGAL REGIME

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This chapter describes the legal regime that applied to mining licences granted or applied for prior to 1991, the new regime established by the Resource Management Act 1991 and the Crown Minerals Act 1991, and the transitional regime. The transitional regime applies to mining activities established under the Mining Act 1971 and the Water and Soil Conservation Act 1967, and which are continuing. The mines which are currently operating and using tailings dams largely obtained their mining licences under the Mining Act 1971 and water rights pursuant to the Water and Soil Conservation Act 1967. They are therefore regulated by the transitional provisions described below, although, in some situations, they may also require consents under the Resource Management Act 1991. The chapter also briefly covers the common law position and proposals for legislative reform, and whether the regimes provide for the long-term management of sites containing tailings dams.

The old regime is discussed in chapter 2.1; the transitional regime in chapter 2.1; and the new regime in chapter 2.3. Chapter 2.4 examines proposed new legislation. The common law remedies of negligence and nuisance are discussed briefly in chapter 2.5. Chapter 2.6 considers the roles and responsibilities, in respect of the long-term management of tailings dams, of public authorities, mining companies and the land-owner or occupier. By way of summary, the main points of this chapter are repeated in chapter 2.7.

Before 1 October 1991,<sup>1</sup> mining was regulated by the Mining Act 1971, the Coal Mines Act 1979, the Petroleum Act 1937, and the Water and Soil Conservation Act 1967. The Mining Act applied to all gold and silver and other Crown-owned minerals, except coal and petroleum. The emphasis of the Mining Act was on fostering the growth of the mining industry.

### 2.1 The old regime

The Mining Act provided for a system of licensing the mining of gold and silver and other Crown-owned minerals. The generic name for the various licences that could be granted was mining privileges. The term ‘mining privileges’ was defined as –

#### 2.1.1 The Mining Act 1971

any licence, right, title, easement, or privilege relating to mining ... and includes the specific piece of land in respect of which the licence etc is so granted or acquired.

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<sup>1</sup> The date upon which both the Resource Management Act 1991 and the Crown Minerals Act 1991 came into force.

The mining privileges which could be granted under the Mining Act included prospectors' rights, prospecting licences, exploration licences, and mining licences.

Mining licences granted under the Mining Act 1971 included a right to occupy and use the land overlying the minerals, whether or not the land was privately owned. Mining licences were not subject to town planning legislation, but licence holders still needed to obtain water rights (ie, to take or discharge water) under the Water and Soil Conservation Act 1967. No consents were needed specifically for the construction of tailings dams; a mining licence entitled the holder to 'do all acts and things that are necessary to effectually carry out mining operations',<sup>2</sup> however, water rights could be drafted to control the design and construction of tailings dams. 'Mining operations' was defined to include the construction of dams.<sup>3</sup>

### **Environmental assessments**

Applicants for prospecting and mining licences were required to prepare environmental assessments (ss 49(1) and 70 Mining Act) and include these assessments with their applications for licences. No statutory guidance was given on what should be covered by the environmental assessment or in how much detail, other than a requirement that specific details of access requirements should be included.<sup>4</sup> However, the Government's *Environmental Protection and Enhancement Procedures* (EP&EP) applied, inter alia, to the granting by the Crown of all licences, authorisations, permits, and privileges which may have environmental implications and which are issued pursuant to a number of Acts listed, including the Mining Act 1971. Paragraph 5 of the EP&EP set out the purposes of the environmental assessment, which were to:

- (a) determine and evaluate the environmental impact of possible actions to enable a choice to be made between various options;
- (b) determine whether or not the possible actions being considered would affect the environment significantly and would require the preparation of an environmental impact report;
- (c) determine whether or not any measures should be taken to improve the environment, minimise or avoid damage to it in the course of developing or implementing a proposal irrespective of whether or not an environment impact report has been or is to be prepared.

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<sup>2</sup> Section 87 Mining Act.

<sup>3</sup> Section 5 Mining Act.

<sup>4</sup> Clause 3 and Form MD 5, Mining Regulations 1981 (SR 1981/347).

On the basis of the environmental assessment, it might be determined that an environmental impact report (EIR) should be prepared by the applicant for the licence. The EIR was to clearly set out the environmental consequences of a proposed action and of the alternatives to that action, and ways of avoiding or ameliorating any harmful environmental consequences. Appendix A to the EP&EP provides a format for EIR, including guidance as to the effects to be considered. These included primary and secondary effects, long-term effects, and the probability of an effect occurring whether or not any changes are irreversible or will alter or consume an irreplaceable resource. In considering the effects, the EIR was also to assess the magnitude, intensity, and significance of the effect; and identify the area of uncertainty.

The completed EIR was sent to the Commission for the Environment (and later the Parliamentary Commissioner for the Environment) for an environmental impact audit, which would provide an independent opinion on the environmental implications of the proposal. Both the EIR and the environmental impact audit would be published.

### **Conditions**

Mining licences could be granted subject to conditions, which covered the prevention or reduction of injury to land as the Minister thought fit. Such conditions could relate to the disposal or discharge of any mineral, material, debris, tailings, refuse, or waste water produced from the exercise of the mining privilege (s 103A). Section 103D provided for the variation of conditions of mining licences. A proposed variation was required to be notified first to the licence holder and the territorial authority and then publicly. Objections could be made within 20 working days after the public notice was given; the variation then became the subject of an inquiry by the Planning Tribunal. The Planning Tribunal made a recommendation to the Minister, upon which the Minister was required to act. There was provision for forfeiture of mining privileges for contravention of the Mining Act (s 118).

Access to private land<sup>5</sup> for mining purposes was a matter initially left to the mining privilege holder to negotiate with the owner and occupier of the land (s 36). However, if the owner or occupier refused consent to the grant of the mining privilege in respect of the land, the applicant could apply to the Crown to have the land declared open for mining as if it were Crown land (s 37). All Crown land was open for mining unless the Minister had specifically exempted it (ss 21 and 24). Once the owner and occupier had given consent, that consent was irrevocable

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<sup>5</sup> 'Private land' for the purposes of the Mining Act 1971 was land held in fee simple over which the Crown did not both own the mineral rights and have rights of access to the minerals (Mines Division of the Ministry of Energy, *Mineral Ownership* 1986). Refer to s 5 Mining Act 1971 for full definition of 'private land'.

and binding on successors in title (s 105). However, if the owner or occupier had given consent on certain conditions, those conditions were deemed to be conditions attached to the mining privilege if it were granted. In addition, the owner or occupier could serve on the Minister and the applicant a written notice requiring conditions to be attached to, and specified in, the mining licence, subject to a right of objection to unreasonable conditions.<sup>6</sup> Those conditions could relate to:<sup>7</sup>

- preventing or reducing injury to the surface of the land;
- restoration of the surface of the land after completion of mining; and
- preventing or reducing interference with the use of the land or adjacent land by the owner or occupier of the land covered by the licence.

The Mining Act provided no right of renewal, but it did provide the existing licence holder with a right (in priority to other applicants) to have an application for a replacement licence considered and processed.

### **Bonds<sup>8</sup>**

From 1981, a bond or monetary deposit was required as security for compliance with the terms and conditions of a mining privilege. A mining privilege could not be issued until the bond or monetary deposit had been lodged.

The Minister of Energy had power to review the amount secured by the bond or the monetary deposit on a three-yearly basis. Where he or she was satisfied that the amount of the bond was insufficient to meet:

- first, the cost of restoration of land injuriously affected by the holder's operation, and then
- any money owed to the Crown in respect of the mining privilege

The Minister could increase the bond or deposit at that time. There was no provision for the Minister to decrease the amount secured or deposited.

On the termination or transfer of the mining privilege, and provided that the privilege holder had substantially complied with the terms and conditions of the mining privilege, the monetary deposit was to be refunded or the bond released, less such amount as had been spent to restore or protect any property.

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<sup>6</sup> Sections 103D, 103E and 106 Mining Act.

<sup>7</sup> Section 105(2) Mining Act.

<sup>8</sup> Section 108A Mining Act as inserted by the Mining Amendment Act 1981.

If the privilege holder had not substantially complied with the terms and conditions of the privilege, the Minister could direct that all or any part of the deposit should be forfeited and any balance refunded to the privilege holder. However, the Minister could retain all or part of the deposit for such further period as he or she considered necessary. The Minister could apply any money forfeited as if it were rent or royalties payable by the privilege holder.

The Planning Tribunal, in the course of undertaking an inquiry under s 126 of the Mining Act 1971 into an application for a mining licence No 32 2388 by Waihi Gold Company,<sup>9</sup> considered the status of bonds entered into under s 108A of the Mining Act. In Appendix 5 to the Report and Recommendations, the Planning Tribunal commented:

It is clear from the language of section 108A that a requirement for a bond of whatever amount stands independent of the conditions of a mining licence, which are the subject of separate provision under inter alia section 103A and section 104 of the Act, and are expressly included in the scope of the Tribunal's jurisdiction under subsection (5) of section 126.

This raises the question: even though the bond was lodged as security for the privilege holder's compliance with the terms and conditions of the privilege, does the bond necessarily have to be realised or released when the mining privilege terminates? The proviso to s 108A(6) provides the Minister with a discretion to continue to hold the bond for 'such further period as he considers necessary'.

Does this mean that the bond can be used to fund remediation work which was not required by the mining privilege and the need for which becomes apparent after the privilege has terminated? If this is the case, then there appears to be a contradiction between what the bond was lodged to secure and what it may be used for. Alternatively, it may be that the proviso to s 108A(6) merely authorises the Minister to hold the bond long enough to ensure that there really has been compliance. In any case, the Minister's exercise of that discretion would have to be reasonable and justifiable in the circumstances, and it would be unlikely that the Minister could hold onto the bond for an indefinite period.

This Act was passed to 'make better provision for the conservation, allocation, use, and quality of natural water'.<sup>10</sup> Section 21 vested in the Crown the sole right to take, use, or discharge water or wastes into, natural water. The Act enabled any person to apply to the Crown for a right to take, use, or discharge water or wastes into, natural water. The

## **2.1.2 The Water and Soil Conservation Act 1967**

<sup>9</sup> A48/87, Wellington, 8 June 1987, Judge Sheppard.

<sup>10</sup> Long title to Water and Soil Conservation Act.

water rights were granted for specified periods or indefinitely, and were transferable.

The Water and Soil Conservation Amendment Act 1971 applied to mining privileges relating to water granted under the Mining Act 1926, and repealed the relevant provisions of that Act. Mining privileges provided various rights in respect of water and the land covered by the privileges. The various types of mining privilege were water race licences, dam licences, drainage area licences, and tail race licences.

This Act did not provide specifically for bonds to be entered into in respect of water rights. However, express provision was not necessary, and such bonds could be required as a condition of the water right to secure the performance of the water right holder's obligations under the right and to provide security for remedying any damage caused by the holder. Inter alia, the bond might provide for the bond to continue for the full term of the right even if the holder surrendered the privilege before the term had expired. Upon expiry of the right (or all of them if there were a number), the bond would be released, subject to the mining company having complied with the terms and conditions of the right, and provided that the likelihood of damage to natural water from the rehabilitated mining site was not greater than that from adjacent undisturbed land.

## **2.2 The Transitional Regime**

The Resource Management Act and the Crown Minerals Act were passed in 1991 and put in place a new regime for the management of mining activities. Mining activities which had been licensed under the old regime of the Mining Act 1971 are now subject to a transitional regime which combines features of the old and new regimes.

### **2.2.1 The Crown Minerals Act 1991**

Mining privileges existing when the Crown Minerals Act (CMA) came into force are to continue as if the CMA and RMA had not been enacted.<sup>11</sup> However, the functions, powers and duties previously exercised by the Minister of Energy in respect of any existing mining privilege, or any condition of such privilege, or any provision of any Act that relates to any existing privilege, and that concern matters that are within the functions of local authorities under ss 30 or 31 RMA, are to be exercised by the appropriate local authority.<sup>12</sup> This means that the responsibility for administering the environmental conditions of licences and bonds falls on local authorities even though it was the Minister of Energy who imposed the conditions.

There is no provision for local authorities to recover the costs of monitoring the environmental conditions of licences, although levies continue to be payable under the Ministry of Energy (Abolition) Act 1989 in respect of the functions formerly undertaken by the mines

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<sup>11</sup> Section 107 CMA.

<sup>12</sup> Section 108 CMA.

inspectors. Section 108(6) CMA provides that references in s 108 to the Minister of Energy include any references to the Secretary, any inspectors, or any other statutory officers appointed under the Mining Act (and the Water and Soil Conservation Act). This provision has the effect that s 108(1) must be read as transferring all the functions, duties and powers of all these officers to the appropriate local authority where those functions, duties and powers are to be exercised in relation to the environmental conditions of licences. Under the Mining Act, inspectors had a number of functions, including to ensure that all the conditions of mining licences were being complied with, and all such powers as may be necessary to carry into effect the provisions of that Act.<sup>13</sup> Section 15 of the Mining Act provided that costs incurred by inspectors were to be met out of public money appropriated by Parliament. Arguably, this provision should also apply to local authorities where they are fulfilling the role of inspectors, especially as levies to fund these functions continue to be imposed on the mining industry.

The Ministry of Commerce, on behalf of the Crown, continues to be responsible for the monitoring and enforcement of the non-environmental conditions of licences, including conditions relating to occupational health and safety. The mines inspectors, who formerly monitored compliance with all the conditions of licences, now monitor only the non-environmental conditions. The mines inspectors are now part of the Energy and Resources Division of the Ministry of Commerce, and their expertise is not available to local authorities.

Section 109 CMA deals with bonds and monetary deposits paid under s 108A of the Mining Act. It provides that the Minister of Energy shall continue to hold the money, but the relevant local authority has first priority to half of the amount of any bond or monetary deposit for the purpose of restoring or protecting any property injuriously affected or endangered because of the licence holder's failure to comply with the conditions of the licence. The Minister has a priority right to the other half of the bond or monetary deposit to cover any payments due to the Crown, such as royalties. On the basis of s 108(1) CMA, it would appear that either the Minister of Energy or the relevant local authority may increase the amount of a bond where it is insufficient to meet the amount payable under s 108(5) of the Mining Act.<sup>14</sup> There is no provision for the Minister of Energy or local authorities to review the conditions of the bond, other than the amount. As a bond is a contract, variation of its conditions can only be achieved by negotiation with the licence holder.

The possibility that it might not be clear who was responsible for exercising a particular function, power, or duty was foreseen by the drafters of the CMA. Section 108(2) provides that where such doubt cannot be resolved by agreement, an application may be made to the

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<sup>13</sup> Section 12 Mining Act.

<sup>14</sup> Refer to para 2.1.3 above.

Environment Court for an order determining the matter. However, in 1991, the Ministry of Commerce published a document dealing with the transition from the Mining Act to the RMA which included a sample set of conditions. These conditions were annotated to indicate which conditions the Ministry considered were environmental, those which were not, and those where there was an overlap of responsibility between local and central government.<sup>15</sup>

The Act also assumes that the Minister of Energy will continue to have a role in varying the non-environmental terms and conditions of existing privileges or in taking enforcement action against the holder of a privilege.<sup>16</sup> The Minister has a broad discretion in varying conditions of licences, although the licence holder has a right to object. Where the Minister takes such action he or she is required to give written notice to the local authority which has functions, powers and duties in relation to the privilege (s 108(3)). Similarly, local authorities have a broad discretion to vary conditions of licences. Where the local authority varies the terms and conditions or takes enforcement action, it is required to give written notice to the Minister. For the purposes of enforcement, a local authority has all the powers conferred on an enforcement officer by s 332 RMA, which relates to abatement notices.

Applications for mining privileges made under the Mining Act, but not determined before the CMA was enacted, are to be dealt with under the Mining Act as if the CMA had not been enacted (s 112 CMA). Applications for an exploration licence, prospecting licence, or mining licence made under the Mining Act, but not determined before the CMA was enacted, are deemed to be applications under the CMA for a minerals permit. However, exploration licences, prospecting licences and mining licences are also mining privileges, so, in effect, the applicant may choose which piece of legislation should apply. As mining licences may not be extended or renewed, licence holders will need to apply under the CMA for any new rights which will be termed 'permits'.

The maximum term of mining licences granted under the Mining Act was 42 years from the date they were granted (s 77). The term is unaffected by the enactment of the CMA so the mining licences will expire, at the latest, 42 years from the date of the grant.<sup>17</sup> Those mines which are currently operating and using tailings dams largely obtained their mining licences under the Mining Act 1971. As the Mining Act did not make provision for a right of renewal of mining licences, nor for

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<sup>15</sup> Ministry of Commerce *Crown Minerals Act 1991 – Transition to a New Resource Management Administration*, August 1991.

<sup>16</sup> Section 103D Mining Act provides for variation of the conditions of mining privileges.

<sup>17</sup> However, mining licences may be granted for any term up to 42 years, (eg, Golden Cross (30 years), Martha Hill (30 years), and Round Hill (21 years)).

extension of the time period of licences, new permits will need to be applied for under the CMA.

Any water rights or current mining privileges deemed to be water or discharge permits by s 413 RMA will expire 30 years from the date of enactment of the RMA (s 413(3) RMA). When the mining privileges in respect of water expire, new water permits may need to be applied for under the RMA.

Where a mining company wishes to continue mining activities after the expiry of their mining licence and any deemed water or discharge permits, it may require consents under the RMA in addition to those replacing the deemed water or discharge permits.

The RMA transitional provisions deem mining privileges relating to water granted under the Mining Act and water rights granted under the Water and Soil Conservation Act to be variously water permits, discharge permits, or a permit conferring a right over land not owned by the permit holder (s 413 RMA). The permits are deemed to have been granted by the appropriate consent authority under the RMA on the same conditions as they were originally granted and are subject to the provisions of the RMA. Also included as conditions of the deemed permits are those sections of the Water and Soil Conservation Act which applied to the particular mining privilege or water right before the RMA was enacted. Every deemed water or discharge permit expires on the thirtieth anniversary of the commencement of the RMA, namely 1 October 2021 (s 413(3)).

## **2.2.2 Resource Management Act 1991**

Deemed permits are specifically not subject to ss 128 to 132 RMA which provide for review of conditions. However, when a deemed permit is transferred to a subsequent owner or occupier of the land affected it becomes subject to ss 127 to 132 (s 413(8) and (9)). Although there appears to be no authority for local authorities to recover the costs incurred in monitoring the environmental conditions of mining licences granted under the Mining Act, deemed permits are consents under the RMA and, accordingly, ss 35 and 36 apply to enable the local authorities to monitor the exercise of deemed permits and recover the cost from the consent holder through charges fixed under s 36 RMA.

No enforcement order may be made against a deemed permit holder in respect of any activity to which the deemed permit relates, except on the application of the relevant regional council or a Minister of the Crown (s 413(6)).<sup>18</sup>

Any activity affecting a tailings dam to which the transitional regime applies, but which is not authorised by the mining licence, must comply

<sup>18</sup> In other situations, any person may apply for an enforcement order: s 316 RMA.

with the relevant provisions of the district plan and the regional plan, and may require resource consents.

Where consents have already been granted and do not provide adequately for review of conditions, the discovery of an unforeseen risk relating to the activity the subject of the consent may activate the consent authority's power to review the conditions of a resource consent under s 128(1)(c). This could be justified on the basis that such risk has rendered the original consent application and its supporting information inaccurate and more appropriate conditions should be attached.

## **2.3 The New Regime**

A new regime comprising the Crown Minerals Act and the Resource Management Act applies to mining activities to be commenced after 1 October 1991.

### **2.3.1 The Crown Minerals Act 1991**

The CMA is concerned only with the allocation of the Crown-owned minerals and with rights of access to land for mining purposes. The management of minerals is undertaken through minerals programmes which set out a management scheme and guidelines for allocation and pricing. The purpose of a minerals programme is to establish policies, procedures and provisions to be applied in respect of the management of any Crown-owned mineral that is likely to be the subject of an application for a minerals permit. In particular, the programme is to provide for the efficient allocation of rights in respect of Crown-owned minerals and to allow the Crown to obtain a fair return from its minerals.

There are three different sorts of minerals permits, namely for prospecting, exploration and mining. Each permit is restricted to the specific mineral and land named in the permit. When applying for a mining permit the applicant must supply a work programme to the Secretary of Commerce. In granting a permit the Minister of Energy must act consistently with the relevant minerals programme, or if there is no minerals programme the Minister must have regard to the importance of the efficient allocation of rights to Crown-owned minerals and the obtaining of a fair financial return from the minerals. The holders of prospecting and exploration permits have the right to obtain the next permit up (an exploration or mining permit) subject to satisfying the Minister that

- the results of the prospecting or exploration justify moving on to the next stage;
- the work programme is adequate; and
- the permit holder will comply with the conditions and give proper effect to the permit.

Minerals permits may be granted on such conditions as the Minister thinks fit, including a requirement for a bond or monetary deposit to ensure compliance.

Access to land for the purpose of mining is no longer a right automatically attached to a minerals permit. Under the CMA, access arrangements must be negotiated with the land-owner. Where the owner refuses access, the matter may be referred to arbitration if the Governor-General makes a declaration to such effect, although no access issue has been referred to arbitration under the CMA. Access to Crown land is also to be negotiated with the responsible Minister, who must have regard to the objectives of any Act under which the land is administered, the purposes for which the land is held, any relevant policy statements or management plans of the Crown, any safeguards against adverse effects, and any other matters the Minister considers important.<sup>19</sup> Certain classes of land are not subject to an arbitrator's determination of access rights, eg, land held under the Conservation Act, Maori land, land used as a garden, orchard, vineyard, or indigenous forest, or land having an area of 14.05 ha or less. In practice, access to private land is subject to the consent of the land-owner.<sup>20</sup>

### **Fees, royalties and levies**

The Crown Minerals (Fees) Regulations 1991<sup>21</sup> provide for the collection of application and annual fees payable by applicants for permits or permit holders respectively. The annual fee for a mining permit is \$11.25 per hectare or part of a hectare.<sup>22</sup> The application fee for a mining permit is \$1,687.50.<sup>23</sup> Different fees apply for prospecting and exploration permits.

The Crown also collects royalties. The royalty rate set out in the Minerals Programme for Minerals is 1% of the value of production or 5% of accounting profits whichever is the greater.<sup>24</sup>

The Ministry of Energy (Abolition) Act 1989 provides for levies to be recovered and to be applied for meeting the reasonable costs and expenses of:<sup>25</sup>

- the inspection, monitoring, and related services to which they relate and matters incidental thereto (ie services and matters carried out by the Ministry of Commerce under any Act); and
- the recovery of those levies.

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<sup>19</sup> Section 61 CMA.

<sup>20</sup> David McGregor, personal comment.

<sup>21</sup> SR 1991/207.

<sup>22</sup> Clause 5 of the Regulations.

<sup>23</sup> Clause 7 of the Regulations.

<sup>24</sup> *Brooker's Resource Management* Vol 2, para B12.06.

<sup>25</sup> Section 14 Ministry of Energy (Abolition) Act 1989.

Any levies imposed are payable to the Secretary of Commerce by, inter alia, the owners of coal mines, and mineral mines, and by the holders of prospecting licences.<sup>26</sup> The levies in respect of gold and silver mines are based on the amount of minerals extracted or the area of the mine, whichever is the greater. Where other minerals are extracted, the levy is based on the area of the mine. The levy payable in respect of prospecting licences is a fixed sum of \$1000 or such lesser sum as is prescribed for six months, with a lesser fixed amount of \$250 payable per six-month period during which the licence was not worked.

### 2.3.2 The Resource Management Act 1991

Where applications for mineral permits are processed under the CMA, the mining operator will have to apply for resource consents under the RMA, subject to the provisions of the relevant regional and district plans. Conceivably, a mining operator may have to apply to the district council for a land use consent; to the regional council for a permit to take water, discharge to water, and/or discharge to air; and to the Minister of Energy for the mineral permit. A building consent granted by a territorial authority under the Building Act 1991 would also be required for the construction of a tailings dam.

#### Environmental Effects and Risk Assessment<sup>27</sup>

Section 88(4)(b) of the RMA requires that every application for resource consent should include an assessment of any actual or potential effects that the activity may have on the environment, and the ways in which any adverse effect may be mitigated. The assessment of environmental effects (AEE) is required to be in such detail as corresponds with the scale and significance of the actual or potential environmental effects of the activity. An AEE under s 88 is to cover the matters set out in the Fourth Schedule to the Act.

The requirement to address *potential* effects implies a requirement to include a risk assessment, as part of the AEE. The broad definition of 'effect' strengthens this implication as it includes:

- (e) Any potential effect of high probability; and
- (f) Any potential effect of low probability which has a high potential impact.

However, the need for a risk assessment is explicit in the case of hazardous installations. Clause 1 of the Fourth Schedule provides that an AEE should include:

<sup>26</sup> Section 15 – coal mines; s 16 – mineral mines; and s 17 prospectors.

<sup>27</sup> This section on risk assessment is based on an opinion provided by Royden Somerville to the Parliamentary Commissioner for the Environment, 29 May 1997.

- (e) Where the activity includes the use of hazardous substances and installations, an assessment of any risks to the environment which are likely to arise from such use.

Clause 2 of the Fourth Schedule provides that any person preparing an AEE should consider a number of matters, including:

- (f) Any risk to the neighbourhood, and the wider community, or the environment through natural hazards or the use of hazardous substances or hazardous installations.

Although ‘hazardous installation’ is not defined in the RMA, the very fact that legislation is being prepared to deal with issues of dam safety suggests that dams are hazardous installations. Even if this were not the case, tailings dams would qualify for a risk assessment under clauses 1(e) and 2(f) of the Fourth Schedule as tailings dams may be intrinsically hazardous and may contain substances which are or become hazardous.

Assuming that a risk assessment is required in respect of a tailings dam, the risk assessment should cover ‘*any risks to the environment which are likely to arise from [the use of hazardous substances and installations]*’.

‘Any risk’ is a very broad formulation of the risk that must be addressed in the assessment of effects. It is suggested that ‘any risk’ equates with ‘any identifiable risk’ irrespective of the likelihood of occurrence or magnitude of the consequences. The wide definition of ‘effect’ supports a broad interpretation of ‘any risk’, which would include the worst case scenario.<sup>28</sup>

The wide definition of ‘environment’ implies that if an event occurs, it will very likely affect one or another element of the environment. Section 2 RMA defines ‘environment’ as including:

- (a) Ecosystems and their constituent parts, including people and communities; and
- (b) All natural and physical resources; and
- (c) Amenity values; and
- (d) The social, economic, aesthetic, and cultural conditions which affect the matters stated in paragraphs (a) to (c) of this definition or which are affected by them.

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<sup>28</sup> Courts in other jurisdictions require parties to consider a worst case scenario: refer to *Sierra Club v Sigler* 695 F2d 957 (5th Cir 1983); *Scientists’ Institute for Public Information v Atomic Energy Commission* 481 F2d 1079 (DC Cir 1973).

The RMA provisions for the recognition and protection of Maori values and priorities bring another dimension to the assessment of potential risks. The traditional relationships of Maori with their ancestral lands and special sites, with water, and with other taonga (valued resources), the role and responsibilities of kaitiakitanga (traditional guardianship), and the principles of the Treaty of Waitangi, all must be included in the overall assessment.

The risks to the environment which must be included in the risk assessment are those risks that are *likely* to arise. ‘Likely’ implies a degree of probability, rather than mere possibility, although low probability should be sufficient to justify inclusion in the assessment where the consequences of the risk, should it crystallise, are serious. The requirement for a comprehensive risk assessment addressing ‘any risk’ is a prerequisite to the application of the precautionary approach, which has been accepted by the Environment Court as a factor which must be considered by consent authorities under s 104 RMA.<sup>29</sup>

On the basis of the risk assessment and any consultation with affected parties, the consent authority will determine what (if any) is the acceptable risk in the circumstances, and how risks are to be managed (eg, through conditions on consents).

The AEE is also required to set out the ways in which any adverse effect may be mitigated. Where potential, rather than actual, effects are concerned, measures such as contingency plans (ie, to address possible emergencies) and residual risk assessments (ie, an assessment of the remaining risks once the site has been cleaned up to the required standard) may assist in their mitigation.

### **Conditions**

Section 108 of the RMA enables a consent authority to impose conditions on the grant of a resource consent. A condition may be imposed which requires the consent applicant to make a financial contribution (as defined in s 108(9)) for purposes specified in the relevant plan.<sup>30</sup> Financial contributions are not to exceed in value the maximum amount specified or determined in accordance with the plan. A financial contribution may be in the form of: money; land; works (including tree planting, the protection, restoration, or enhancement of any natural and physical resources); services; or a combination of such forms. A financial contribution cannot be required if there is no provision for it in the relevant plan. Although drafted in broad terms, s 108(1)(a) originated in the provision for a reserve contribution on subdivision under the Local Government Act 1974. Considered against this background, it is unclear whether a financial contribution could be required to fund long-term monitoring and maintenance of tailings dams.

<sup>29</sup> *McIntyre v Christchurch City Council* [1996] NZRMA 289; *Telecom New Zealand v Christchurch City Council* W165/95.

<sup>30</sup> Section 108(1)(a) RMA.

Section 108 also provides for a condition requiring that a covenant be entered into in favour of the consent authority in respect of the performance of any condition of the resource consent, being a consent relating to the use of the land subject to the consent (s 108(1)(c)). Section 109 CMA deems every such covenant to be an instrument creating an interest in land. The covenant may be registered under the Land Transfer Act 1952. Registration means that the covenant will bind all subsequent owners of the land. A condition requiring that a covenant be entered into could only be imposed on a mining operator who also owned the land to be mined.

### **Bonds**

A condition may be imposed on a consent, requiring that a bond be given in respect of the performance of any other condition(s) of the consent.<sup>31</sup> The bond conditions may, inter alia –

- require that s 109(1) apply to the bond, except that in the case of a land use or subdivision consent, s 109(1) automatically applies. Section 109(1) deems a bond to which it applies to be an instrument creating an interest in land which is registrable under the Land Transfer Act 1952. Once registered the bond is deemed to be a covenant running with the land which binds successors in title;
- provide that the consent holder remains liable for any breach of conditions of the consent which occur before the consent expires, and for any adverse effects on the environment which become apparent during or after the consent expires;
- require the consent holder to provide security for the performance of any condition of the bond;
- require the consent holder to provide a guarantor acceptable to the consent authority to fulfil any condition if the consent holder defaults, or to remedy any adverse environmental effects; and
- provide that the bond may be varied, cancelled, or renewed at any time by agreement between the consent holder and the consent authority.

Where a bond registered under the Land Transfer Act 1952 is varied, cancelled or expires, the register is amended accordingly. If the consent holder fails to fulfil a condition of the bond requiring work to be done, the consent authority may enter onto the land and complete the work. The territorial authority may recover the cost of doing the work itself from the consent holder out of money or securities deposited with the consent authority or money paid by the guarantor. Any money left over is to be repaid to the consent holder or the guarantor. If there is a shortfall in the money available to reimburse the consent authority for the cost of completing the work, that shortfall becomes a debt due and a charge on the land.

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<sup>31</sup> Section 108(1)(b) RMA.

It appears that the RMA contemplates that a bond entered into as a condition of a consent may continue in existence according to its terms beyond the date upon which the consent expires, as a bond entered into under ss 108 and 109 of the RMA may provide for the consent holder to remain liable under the RMA for any adverse effects on the environment which become apparent during or after the consent expires. However, a bond would have to terminate after a specific period. There would also be practical problems with an open-ended bond, such as obtaining insurance for an indefinite period and ensuring that the premium was paid on a regular basis. Security for the performance of any condition of a bond may be required (s 108(6)(d)).

### **Emergencies**

Where there is a need for urgent action to restore land damaged as a result of the mining operation, or to prevent such damage occurring, the RMA provides that the consent authority which has jurisdiction — rather than the applicant — or, where relevant, the network utility operator approved as a requiring authority, may undertake the necessary work without being required to obtain a resource consent (s 330(1)). Alternatively, the consent authority may direct the occupier of the affected land to undertake the work. Where the adverse effects of any remedial or preventative work undertaken under s 330(1) are continuing, the person who undertook the work must apply for the appropriate consent within 20 days of having notified the consent authority that it has undertaken the work.

The RMA imposes a duty to avoid, remedy, or mitigate adverse effects on the environment upon *the person undertaking the activity* whether or not the activity is in accordance with a rule in a plan, a resource consent, or is an existing use or activity.<sup>32</sup> Although this duty is expressly not enforceable against any person, s 17(3) provides that an enforcement order or an abatement notice under Part XII of the RMA may be made or served to:

### **2.3.3 Enforcement of the RMA**

- (a) require a person to cease, or prohibit a person from commencing, anything that in the opinion of the Environment Court or enforcement officer, is or is likely to be noxious, dangerous, offensive, or objectionable to such an extent that it has or is likely to have an adverse effect on the environment; or
- (b) Require a person to do something that, in the opinion, of the Environment Court or an enforcement officer, is necessary in order to avoid, remedy, or

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<sup>32</sup> Section 17 RMA.

mitigate any actual or likely adverse effect on the environment caused by, or on behalf of, that person.

In other circumstances, an enforcement order may also be made under s 314 or an abatement notice may be served under s 322. Generally, any person may apply to the Environment Court for an enforcement order where the order is sought against the person who has caused the adverse effects or is not complying with legal obligations under the RMA. Only the consent authority may apply to the Court for an order against the owner or occupier of land to which the adverse effects relate,<sup>33</sup> or to obtain a change or cancellation in a resource consent.<sup>34</sup>

The Environment Court has discretion to decide whether or not to grant an enforcement order, and it may do so on such terms and conditions as it thinks fit. The Environment Court may order that an enforcement order will apply to the personal representatives, successors and assigns of a person to the same extent as it applies to that person. This could provide a mechanism for ensuring that later owners of a property which has been mined are held responsible for avoiding, remedying or mitigating adverse effects.

Abatement notices<sup>35</sup> may be served on any person, who is contravening their legal obligations under the RMA *and* causing adverse effects on the environment, by an enforcement officer of a local authority. Similarly, abatement notices may be served on the owner or occupier of that land to which the adverse environmental effects relate, where that owner or occupier has failed to comply with their legal obligations under the RMA. An abatement notice may also be served on the mining company where the adverse effects are connected with non-compliance with consents or the relevant plan. An abatement notice may be challenged in the Environment Court.

However, ss 319(2) and 325(5) may protect the person who caused the adverse effects, or the owner or occupier of the affected land, from enforcement action where that person is acting lawfully in accordance with a rule in a plan or a resource consent, if the adverse effects were expressly recognised by the person who approved the plan, or notified the proposed plan, or granted the resource consent, at the time of that approval, notification, or granting. Even so, the Environment Court may decide that it should make an enforcement order if, having regard to the time which has elapsed and any change in circumstances since that action, it considers it appropriate to do so. In the case of adverse effects arising from a mining operation some time after mining has ceased, a substantial period of time may have elapsed since the permits and consents expired, and contamination which did not exist or was not apparent may since have arisen or been discovered. The elapse of such period of time and the discovery of contamination may be sufficient to

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<sup>33</sup> Section 314(1)(da) RMA.

<sup>34</sup> Section 314(1)(e) RMA.

<sup>35</sup> Section 322 RMA.

justify the Environment Court making a decision in favour of allowing enforcement action against the owner or occupier.

### **Retrospective application**

There is a presumption in the interpretation of statutes that they are not intended to apply retrospectively unless that intention is clear. There has been some debate as to whether or not the enforcement provisions of the RMA apply retrospectively,<sup>36</sup> since, for the purpose of making enforcement orders, the Act makes no express distinction between acts occurring after the RMA came into force and those which occurred before that time. The RMA focuses on effects and the time at which they arise.

The matter of retrospective application has been considered in an opinion provided to the Ministry for the Environment by the Crown Law Office, which expressed the view that the RMA does not apply retrospectively. The Ministry has based some of its proposals for legislation dealing with contaminated sites on that view.<sup>37</sup>

However, for the time being it is unclear whether or not enforcement orders may be made in respect of adverse effects arising from historic contamination.

Except for the Tui Mine, the mines with tailings dams constructed under the Mining Act are still in operation. It may be difficult in the future to distinguish between effects caused by operations before 1 October 1991 and those caused by later operations. In some instances adverse effects may be caused by events occurring before 1 October 1991, but may be exacerbated by later events. To the extent that any adverse effects, arising after 1 October 1991 in respect of a site where mining commenced before 1 October 1991, can be attributed to activities occurring after October 1991, including deficient rehabilitation, the issue of retrospective application of the RMA may not arise.

### **Offences and penalties**

Where the mining company is served with an abatement notice or enforcement order and fails to comply, it commits an offence under s 338(1) of the RMA. The maximum penalties available for offences under the RMA are fines of \$200,000 or two years' imprisonment. Where any company is convicted of an offence under the RMA, every director and every person concerned in the management of the company

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<sup>36</sup> Professor Kenneth Palmer has commented that '[o]ne may assume the intent of the Act is to be retrospective as to jurisdiction and to cover polluting activities arising prior to 1991' in (1996) 1 *BRMB* 201, 202. John Milligan challenged this assumption and argues that s 314(1)(da) can be construed as retrospective in the objectionable sense: IV(2) *Resource Management News* 15.

<sup>37</sup> Refer to chapter 2.2.

shall be guilty of the same offence if it is proved that action which constitutes the offence took place with the authority, consent, or permission of that person, and that he or she knew or could reasonably be expected to know that the offence was to be committed and failed to take reasonable steps to prevent or stop it (s 340(3)). This provision has serious implications for mortgagees and other lenders who become involved in the management of a company either by the nature of the contract between the company and the lender or where the lender takes over the running of the company as a mortgagee in possession where the company has defaulted on its repayment obligations.

This personal liability relates to offences under the Act and not to responsibility for adverse effects where no offence was committed. Where a director or officer of a company has acted in good faith, he or she is unlikely to be held liable for any environmental damage caused by the company.

Where a company is removed from the New Zealand register of companies, property that has not been distributed or that has been disclaimed vests in the Crown.<sup>38</sup> This may occur either where there are no persons entitled, or the taking of the land entails taking on an onerous obligation which the entitled person repudiates. Under the Companies Act 1993, the Crown may disclaim onerous property, which is defined to include 'property of a company which is unsaleable, or not readily saleable, or which may give rise to a liability to pay money or perform an onerous act'. However, even so, the land may ultimately vest in the Crown at common law.<sup>39</sup> Where the Crown is the owner, it may be liable in tort for breach of the common law duties of owners or occupiers, namely negligence or nuisance.<sup>40</sup>

### 2.3.4 The Building Act 1991

Territorial authorities are responsible for granting of building consents. A building consent is required for all building work, with some exceptions set out in the Act (s 32(2)).

Building' is defined in s 3 as 'any temporary or permanent movable or immovable structure ...' and includes 'any part of a building'. The definition is wide enough to cover dams, although the Third Schedule exempts from the requirement to obtain a building consent 'any dam that retains not more than 3 metres depth, and not more than 20,000 cubic metres volume, of water, and any stopbank or culvert'. All building work, whether or not a building consent is required, must comply with the building code. The owner of land who is contemplating undertaking building work may apply to the relevant territorial authority for a

<sup>38</sup> Companies Act 1993: ss 324 and 325, 269.

<sup>39</sup> DW Elliott 'Land without an Owner' 70 LQR 25; see also *In Re Langford* (1932) 27 MCR 69.

<sup>40</sup> Crown Proceedings Act 1950: s 6(1)(c).

project information memorandum (PIM) in respect of the work.<sup>41</sup> The PIM issued by the territorial authority should include information likely to be relevant to the proposed building work, identifying special features of the land such as erosion potential or the likely presence of hazardous contaminants.<sup>42</sup>

The focus of the Building Act is on ensuring that buildings are safe and sanitary. To this end, territorial authorities, as the administrators of the Act, are to have particular regard to a number of matters including the need to ‘safeguard people from possible injury, illness, or loss of amenity in the course of the use of any building ...’ and the need to ‘provide for the protection of other property from physical damage resulting from the construction, use, and demolition of any building’.<sup>43</sup>

Section 36 of the Building Act makes express provision for the construction of buildings on land subject to erosion or which is otherwise likely to be unstable. The starting point is that the territorial authority should refuse to grant a building consent if the land upon which the building work is to take place is subject to erosion, avulsion, alluvion, falling debris, subsidence, inundation, or slippage, or if the building work is likely to accelerate, worsen, or cause such problems. However, a territorial authority may grant a building consent for a building on such land where it is satisfied that adequate provision has been or will be made to protect the land or the building work, or to restore any damage to the land or other property. Where the territorial authority issues a consent for building work to take place on such land, and the applicant for consent is the owner of the land, the District Land Registrar is to note the granting of the consent on the certificate of title. Section 36(4) expressly provides that where the territorial authority has granted a building consent, that authority shall not be liable to the land-owner, or later purchaser, as a consequence of having granted a consent to build on land which is subject to erosion or other damage. The council may, however, be liable for harm suffered by neighbouring land-owners.

An alteration to an existing dam would be regulated by s 38 of the Building Act, which directs that no building consent be issued for an existing building unless the territorial authority is satisfied that after the alteration the building would continue to comply with the provisions of the building code to at least the same extent as before alteration.<sup>44</sup> Where an authorisation for the alteration had been applied for or obtained before the Building Act came into force, that alteration may

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<sup>41</sup> Section 30 Building Act.

<sup>42</sup> Section 30(2)(a) Building Act.

<sup>43</sup> Section 6(2) Building Act.

<sup>44</sup> Section 38 also requires that the building will comply with the code as to means of escape from fire, and access and facilities for disabled people as nearly as possible as if it were a new building. Clearly these requirements cannot apply to dams.

continue under that prior authorisation as if the Building Act had not been passed.

Sections 64 to 71 address the problem of dangerous and insanitary buildings, and s 73 provides that those sections apply to all buildings whenever constructed. Section 70 authorises the territorial authority to take such measures as are necessary in respect of buildings which present an immediate danger to the safety of people (due to collapse, fire, or earthquake), or where immediate action is necessary to rectify insanitary conditions. Other than where there is a danger of actual dam failure, which could present a danger to people, that is, where the danger is to the environment, s 70 does not enable emergency measures to be taken in respect of tailings dams. However, s 76 empowers officers of the territorial authority to inspect any building and s 74 authorises the territorial authority to carry out work in certain circumstances and recover the cost from the owner, that cost constituting a charge on the land. The power to inspect may also be a duty to inspect in the light of the functions and duties of territorial authorities under s 24 Building Act.<sup>45</sup>

Civil proceedings against the territorial authority, a building certifier, or the Building Industry Authority, in respect of building work may not be brought 10 years or more after the date of the act or omission upon which the proceedings are based. Otherwise the Limitation Act 1950 applies to civil proceedings in respect of building work associated with the design, construction, alteration, removal or demolition of a building, that is no proceedings may be brought more than six years after the date upon which the cause of action accrued.<sup>46</sup> Generally, a cause of action accrues and time begins to run when the plaintiff discovers or could reasonably be expected to have discovered the damage.<sup>47</sup>

## 2.4 Proposed Legislation

### 2.4.1 The Proposed Dam Safety Legislation

The regulation of the design and construction of dams is provided for by the Building Act 1991, the operation of which is administered by territorial authorities. The Ministry of Commerce, Ministry for the Environment and the Department of Internal Affairs have jointly published a discussion paper outlining proposals for legislation to specifically address dam safety.<sup>48</sup> The proposed legislation is intended to be enacted as an amendment to the Building Act.

<sup>45</sup> *Brooker's Resource Management*, Vol 1A, para D76.04.

<sup>46</sup> Limitation Act 1950, s 4(1).

<sup>47</sup> Williams, p 576.

<sup>48</sup> Ministry of Commerce in conjunction with the Ministry for the Environment and the Department of Internal Affairs *Safety Assurance for New Zealand Dams – Proposed Statutory Requirements and Procedures – Discussion Paper*, May 1996.

It is proposed that regional councils will become the public authority responsible for all aspects of dam safety, including the grant of project information memoranda and building consents for dams under the Building Act. Owners will remain primarily responsible for the safety of dams on their property.

The proposed changes will apply to dams which are more than five metres in height and more than 20,000 to 50,000 cubic metres capacity. Such dams will be classified as being of low, medium or high potential impact. Since publishing the discussion paper, the Department of Internal Affairs has advised that it now proposes that all tailings dams should be given a potential hazard classification, irrespective of whether or not they exceed the threshold requirements for height and reservoir capacity.<sup>49</sup>

Hazard classification will be based on the potential effects on 'life, other property or the environment' of an uncontrolled release of water or other material retained by the dam, rather than on the integrity of the dam or the likelihood of dam failure. The classification will depend on such matters as the level of development in the flood path of the dam. Although the proposed criteria for classification refer to the extent of the threat to 'other property or the environment', the actual criteria imply that where the risk is largely to the natural environment (ie, 'undeveloped to occasional structure or agriculture only') the dam will be classified as of low potential impact. The Ministry of Commerce's New Zealand Dam Inventory, which is to be used as the basis for the classification of existing dams, lists the Union tailings dam at Golden Cross<sup>50</sup> and tailings dams belonging to Waihi Gold Mining as of low potential impact.

A dam classified as of high potential impact will require a compliance schedule, that provides for periodic inspection of the dam and any necessary associated work, and an emergency action plan, including provision for warnings of danger. The owner of the dam will also be required to provide a yearly warrant of fitness for the structure.

A dam of medium potential impact will require a compliance schedule which includes procedures for periodic inspection. Although the discussion paper originally proposed that such dams would not be required to have an emergency action plan, officials now propose that the requirement for an emergency action plan should apply to dams of medium potential impact as well as to dams of high potential impact, but that the contents of the emergency action plan for dams of medium potential impact should be a scaled-down version of the contents for the

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<sup>49</sup> Letter from Department of Internal Affairs to Parliamentary Commissioner for the Environment of 21 April 1997. The proposal in the discussion paper is that the legislation will cover dams more than 5 metres in height and which retain more than 20-50,000 cubic metres in volume.

<sup>50</sup> The Union tailings dam has been found to be constructed on a slip.

high-impact dam.<sup>51</sup> A low-impact dam will not be required to have a compliance schedule at all.

Where a dam compliance schedule has been issued, the regional council would be able to issue a notice to rectify under s 45(4) of the Building Act if it were satisfied that the dam owner had not complied with the compliance schedule.

Mine tailings dams pose risks to the environment other than those addressed by the proposed criteria for classification. Their most likely long-term adverse effect on the environment is the contamination of ground water or surface water from the generation of acid leachate. Such an effect may manifest notwithstanding that the dam does not collapse. In the absence of dam failure and the consequent uncontrolled release of tailings, the proposed legislation does not address all the long-term environmental risks posed by tailings dams. The RMA will continue to apply to the *effects*, which the construction and existence of a dam may have on the environment, however the quality of the design and construction of a dam will be relevant to whether problems such as the breach of a dam are likely to arise.

Although the Building Act currently makes some provision in respect of building work on land subject to erosion or other damage, a territorial authority has no specific responsibility to ensure that building work is undertaken on the best site from a safety point of view. This omission in the case of building work such as dams perhaps reflects that the primary focus of the Building Act is on buildings in the narrow sense of houses and office blocks, which tend to be site-specific proposals. There is nothing in the discussion paper to suggest that location will be an issue that regional councils may address when considering applications for consent to construct tailings (or other) dams, other than that location is surely an aspect of design and construction. Location was a matter which the Minister could consider in granting a licence under the Mining Act 1971.<sup>52</sup> To a limited extent, the location issue may be addressed in district plans or regional plans, although alternative locations may be limited by other factors such as the location of ore bodies and economics.

#### **2.4.2 The Proposed Contaminated Sites Legislation**

In November 1995, the Ministry for the Environment published a discussion paper on contaminated sites management.<sup>53</sup> The paper addressed issues relating to historic contaminated sites, ie, those sites which became contaminated before the enactment of the

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<sup>51</sup> See note 48.

<sup>52</sup> Section 126 Mining Act.

<sup>53</sup> Ministry for the Environment *Discussion Document on Contaminated Sites Management* 1995.

RMA. In particular, the discussion paper focused on the question of who is responsible for cleaning up contaminated sites and how the clean up of orphan sites<sup>54</sup> could be funded.

Depending upon the chemical composition of the tailings of a mining operation, such tailings may fall within the definition of ‘contaminated site’ at some stage, such as when discharges of leachate are identified,<sup>55</sup> however, the mining industry is not included in the list of industries that have a potential to cause contamination.<sup>56</sup> Where there is a long-term risk to the environment of acid leachate from a tailings dam or of dam failure which could result in contamination of ground or surface water, tailings dams are likely to fall within the ambit of the proposed contaminated sites legislation.

Issues raised in the discussion paper,<sup>57</sup> which are as equally relevant to tailings dams as to other contaminated sites, are:

- Who is liable?
- Who pays for clean up?
- How are sites going to be cleaned up where nobody is responsible?

The discussion paper outlines what the goals of contaminated site assessment and clean up should be, namely to:

- Render a site acceptable and safe for the long-term continuation of its existing use.
- Minimise environmental and health risks both on and off site.
- Maximise, to the extent practicable, the potential future uses of a site.

The paper acknowledges that in some situations it may be impractical to clean up completely, in which case containing contaminants on the site or using planning controls to limit the use of the site are acceptable options.

A fundamental problem addressed by discussion paper is the issue of applying legislation retrospectively. Historic contaminated sites, by definition, were contaminated before the enactment of the RMA. On the basis of advice from the Crown Law Office, the Ministry for the Environment has accepted that at present ‘there is no comprehensive ability to require the clean-up of sites contaminated prior to the passage of the RMA’. The paper records that ‘the Government has agreed in principle to establish a liability framework to apply to historical (pre-1991) contaminated sites which will apply retrospectively’.

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<sup>54</sup> An ‘orphan’ site is one in respect of which no liable party can be identified, or, if identified, the liable party is unable to pay for the clean up.

<sup>55</sup> See above chapter 1.4.

<sup>56</sup> Above note 53, p 52.

<sup>57</sup> Above note 53, p 3.

The Government has also agreed in principle to allocate liability for historic contaminated sites to any one of the land-owner, the occupier, or the polluter. The legislation may also provide special defences for ‘innocent’ parties, such as owners or occupiers of land who had no involvement with the contamination, and secured lenders in some circumstances.

The definition of ‘contaminated site’ refers to the existence of an actual hazard or a likely hazard immediately or in the future. Once a contaminated site has been cleaned up to the required standard (including where it is impractical to clean up completely, but the contaminants are effectively contained), ongoing monitoring and maintenance will continue to be necessary,

Until recently, the House of Representatives had before it two bills concerned with the prohibition of mining in specified areas.

### 2.4.3 Proposed legislation to prohibit mining

The **Protected Areas (Prohibition on Mining) Bill** was introduced by the Labour Government in September 1990 and referred to the Planning and Development Select Committee where it languished until August 1996. This Government bill was intended to prohibit mining in certain protected areas and in parts of Antarctica claimed by New Zealand. The areas to be protected were national parks, certain reserves under the Reserves Act 1977, wilderness areas under the Reserves Act or Conservation Act 1987, sanctuaries and ecological areas under the Conservation Act, and areas declared to be protected areas by the Governor-General under clause 3 of the Bill. There has been no further progress towards enactment of this bill since the select committee reported back in August 1996, with a recommendation that it be passed as amended by the committee and renamed the Crown Minerals Amendment Bill (No 3). The bill, as amended, would not directly prohibit mining activities, but would prevent the Minister of Conservation from entering into access arrangements in respect of land listed in the proposed new Fourth Schedule to the Crown Minerals Act.

In June 1995, Judith Tizard’s member’s bill, the **Coromandel Hauraki Gulf (Prohibition on Mining) Bill** was introduced and also referred to the Planning and Development Select Committee. It also was reported back to the House in August 1996, with a recommendation that the bill not be passed given the wider scope of the Protected Areas (Prohibition on Mining) Bill in which many of the provisions of this bill are reflected.<sup>58</sup> In March 1997, the motion that the bill should proceed to the next stage was lost and the bill was discharged. This bill was intended to prohibit mining in certain areas of the Coromandel Peninsula and Hauraki Gulf Islands specified in the bill.

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The prohibition of mining in certain areas could also be achieved by rules in regional or district plans.

## 2.5 The Common Law

Whereas the RMA focuses on the effects of activities, the basis of the common law remedies in negligence and nuisance is in interference with private property rights. As such those remedies are available to the party which has suffered harm, and not usually to third parties. The common law applies to all mining operations whenever the licences or permits were obtained, unless modified by legislation.

At common law, there is no duty on a land-owner to clean up a contamination on his or her property, nor is there a power vested in a local authority (or any other body) to order the land-owner to clean up the contamination. However, should that land-owner allow a hazard accumulated on the land to escape from the property and cause damage to the property of another, the first land-owner would be liable to the second under the rule in *Rylands v Fletcher*.<sup>59</sup> Developments in the law since *Rylands v Fletcher* was decided have blurred the distinction between the causes of action under *Rylands v Fletcher* and negligence to the extent that 'negligence law has encompassed and overlain the territory in which *Rylands v Fletcher* operates'.<sup>60</sup>

A remedy in nuisance would depend on the contamination escaping from the land which was subject to the mining and affecting other property. Arguably, it will also require foreseeability of harm.<sup>61</sup> The usual remedies where nuisance is established are damages or injunction.

A remedy in negligence depends on the party harmed (the plaintiff) establishing a number of matters, namely that<sup>62</sup>:

- the mining company (the defendant) owed a duty of care to the plaintiff;
- the harm suffered by the plaintiff was foreseeable;
- the defendant acted in such a way as to breach its duty of care to the plaintiff (ie, was careless);
- the harm was caused by the actions of the defendant's breach of its duty of care;

<sup>59</sup> (1866) LR 1 Ex 265; affirmed (1868) LR 3 HL 330.

<sup>60</sup> Williams at 575, above note 29. This view is based on the House of Lords' decision in *Cambridge Water* and the decision of the High Court of Australia in *Burnie Port Authority v General Jones Pty Ltd* (1994) 68 ALJR 331.

<sup>61</sup> *Cambridge Water Co v Eastern Counties Leather Plc* [1994] 2 WLR 53. See also discussion of this case in DAR Williams *Environmental and Resource Management Law* 1997 Butterworths of New Zealand Ltd, Wellington, 573.

<sup>62</sup> Refer to Todd, Burrows, Chambers, Mulgan and Vennell *The Law of Torts in New Zealand* 1991, The Law Book Company, Sydney, 115.

- the harm was a sufficiently proximate consequence of that breach of duty, ie there was a sufficiently close connection between the breach of duty and the harm suffered.

Even if the risk of harm to the plaintiff were foreseeable, liability would depend upon what action could reasonably have been taken in all the circumstances to avert the risk. Further, the standard of care required is that of a reasonable person in the circumstances; there being a higher standard of care required of persons possessing special skills or expertise. In the case of a dam, a number of experts will have been involved in the design, construction, use, operation, maintenance and closure of the dam. All of these experts would have been required to exercise a degree of care commensurate with their skill and experience, although whether any of them breached their duty of care should not be judged except against the standards of the time in which they acted.

Proceedings in negligence or nuisance must be brought within six years of the date upon which the cause of action accrued.<sup>63</sup> Generally, a cause of action accrues and time begins to run when the plaintiff discovers or could reasonably be expected to have discovered the damage.<sup>64</sup>

Where no land-owner has suffered harm, as may be the case where the contamination is confined to the area covered by the mining licence, no land-owner is able to bring action against the mining company. If the mining company was the owner of the affected land while mining was taking place and either continues to own the land or has sold it to a purchaser who was aware of the contamination, no party has suffered harm although the land remains contaminated. Where the mining company did not own the land but leased it from the owner or had otherwise negotiated access, the lease or access agreement could deal with issues relating to damage to or contamination of land, rehabilitation, and compensation.

Where the owner of the land, upon which the tailings dam is situated, sells that land to a person who is unaware of the existence of the tailing dam or of any potential contamination, the vendor may be liable to the purchaser.<sup>65</sup> Some protection may be afforded to a vendor where the condition of the land and its past use is recorded on the territorial authority's database for inclusion in land information memoranda (LIM). However, not all potential purchasers obtain a LIM before contracting to buy land and there is no obligation on them to do so. Where a purchaser takes the land with notice of the existence of a

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<sup>63</sup> Limitation Act 1950, s 4(1).

<sup>64</sup> Williams, p 576.

<sup>65</sup> *Ware v Johnson* [1984] 2 NZLR 519, where the vendor of a kiwifruit orchard was found to owe a duty of care to potential purchasers and was found liable in negligence for applying a herbicide spray to the property which poisoned the soil and destroyed the kiwifruit plants of the purchaser. Refer to Williams, at 577, note 3.

potential hazard, it is unlikely that that purchaser would have a cause of action against the former owner. Any new owner will become responsible for ensuring that the land is safe for its visitors and will not present a hazard to other land or people on other land.<sup>66</sup>

## 2.6 Management Roles and Responsibilities

### 2.6.1 Public Authorities

#### **The Crown, through the Minister of Energy**

Ownership of the minerals is the basis upon which the Crown is able to license mining and receive royalties for the extraction of minerals. The Minister may grant applications for permits on such conditions as he or she thinks fit. New applications for permits to mine will not be sufficient on their own to enable mining to take place, as land use and other resource consents, and access agreements are likely to be necessary. Section 76 CMA entitles the owner or occupier of land which is injuriously affected<sup>67</sup> as a result of the grant of the permit and the access arrangement to compensation from the permit holder.

The transitional provisions of the CMA have transferred responsibility for ensuring compliance with the environmental conditions of mining licences to local authorities. The Crown remains responsible for ensuring compliance with other conditions of licences, such as those related to health and safety. Where there are new applications for mining permits under the CMA, the Crown is concerned only with the allocation of the mineral resource. The Crown no longer has a duty to take into account environmental matters in considering whether or not to grant a mining permit. Neither does the Crown have the power to impose environmental conditions on mining permits under the CMA. Where there is no breach of duty, there is no liability. Statute law has unequivocally transferred responsibility for the environmental aspects of mining activities to local authorities.

Under the Mining Act 1971, the Crown was responsible for all aspects of the grant of a mining licence, including the imposition of any environmental conditions. The Crown, as grantor of the mining licences under the Mining Act 1971, has exercised a statutory power. Provided it exercised that power fairly in accordance with that Act, it cannot be held liable for any subsequent adverse effects on land of the mining activities.

#### **Local authorities – district and regional**

As noted above, local authorities (both district and regional) are now responsible for monitoring and enforcing the environmental conditions of mining licences governed by the transitional regime, and have first call on half of the amount of the bond attached to a licence. Local authorities are also responsible for the administration and monitoring of

<sup>66</sup> Occupiers' Liability Act 1962.

<sup>67</sup> For discussions on cases on injurious affection see *The Laws of New Zealand* 'Compulsory Acquisition and Compensation', Peter Salmon QC.

any deemed water permits originally granted under the Water and Soil Conservation Act 1967 and any bonds attached to those permits.

Any new applications for mining permits will be subject to the full RMA regime administered by local authorities.

Under the RMA, regional councils are responsible for:

- the control of the use of land for the purpose of maintaining and enhancing water quality (s 30(1)(c)(ii));
- the control of the taking, use, damming, and diversion of water, and the control of the quantity, level and flow of water (s 30(1)(e)); and
- the control of discharges of contaminants into or onto land, air, or water and discharges of water into water (s 30(1)(f)).

A regional council is required to monitor the state of the environment of the whole or any part of its region to the extent necessary to enable it to carry out its functions under the RMA. It is also required to monitor the suitability and effectiveness of any policy statement or plan, and the exercise of the resource consents that have effect in its region. The council is required to take appropriate action (having regard to the methods available to it under the RMA) where its monitoring shows this to be necessary (s 35(2)(a), (b) & (d)).

In undertaking its responsibilities under the RMA, the council is required to recognise and provide for the matters of national importance in s 6, have particular regard to the matters in s 7, and take into account the principles of the Treaty of Waitangi (s 8). Given the particular importance to Maori of water and waterways, both in the physical and spiritual senses, the council will need to work closely with tangata whenua in undertaking its functions under s 30(1).

Territorial authorities (ie, city and district councils) have responsibilities in respect of their functions under the RMA, which are equivalent to those of regional councils discussed above. They also have responsibilities under the Building Act 1991 and the Local Government Official Information and Meetings Act 1987 for the issue of building consents and project information memoranda (PIM), and land information memoranda (LIM), respectively. These memoranda should disclose the nature of the uses to which the subject land has been put and information concerning any contamination of the land. Persons considering the purchase or development of old mining sites should, in theory, be able to make those decisions based on full information. Arguably, a territorial authority may be liable to a purchaser who makes a decision based on a negligently incorrect PIM or LIM and suffers damage as a result.<sup>68</sup>

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<sup>68</sup> K Palmer *Local Government Law in New Zealand* 2nd ed 1993 The Law Book Co Ltd, 112.

Local authorities, generally, have responsibilities to monitor under the RMA, and territorial authorities are responsible for undertaking inspections under the Building Act. Local authorities' responsibilities under the RMA relate to the effects of mining activities undertaken under the transitional and new regimes. Territorial authorities' responsibilities under the Building Act relate to dams whenever they were constructed.

### **2.6.2 The mining company (the consent holder)**

During the term of a mining licence granted under the Mining Act and associated resource consents granted under the RMA, the licence holder is bound by all the conditions of the licence, including the environmental conditions, and the conditions of resource consents. If the licence holder has paid a monetary deposit or entered into a bond, any refund or release from the bond will depend on whether the licence holder has complied with the conditions imposed.

Once the mining licence and resource consents for a mining operation covered by the transitional regime have expired, and the mining company has ceased its mining operations and restored the site as required by the conditions of the licence or resource consents, the mining company has no further liability in terms of the mining licence or consent, except as may be provided for in any bond.

Purchasers of the land upon which a tailings dam is situated will be responsible for the maintenance of the dam under the Building Act 1991, regardless of when the dam was constructed. They may also be liable where the mining company previously owned the land and left the land charged with debts registered against the title to the land.

### **2.6.3 Subsequent owners and occupiers**

Where the mining company cannot be found or made to remedy the adverse effects (perhaps because it no longer exists or is insolvent), the owner is likely to be held liable for remediation.

Under the transitional regime, local authorities have responsibility for the monitoring and enforcement of the environmental conditions of existing mining licences granted by the Minister of Energy. They are able to vary the environmental conditions of licences; and to review the amount of bonds on a three-yearly basis.

## **2.7 Summary**

### **2.7.1 Responsibility for long-term monitoring and maintenance**

Under the new system (the CMA/RMA), central Government allocates the mineral resource, receives royalties and application and annual permit fees, but has no legal responsibility for any environmental effects.

Responsibility for monitoring environmental effects during the mining operation falls to local government. Local authorities continue to have a responsibility to monitor compliance with whichever are applicable of: the Mining Act, mining licences, the RMA, the district and regional plans, resource consents, the Building Act and code, and building consents.

The land-owner/occupier has an implied responsibility to monitor and maintain tailings dams on its property under the Building Act.

Subject to matters of proof, the mining company or a future land-owner/occupier may be liable in negligence for any harm caused to the property of another person.

Under the transitional regime, a local authority may issue an abatement notice under s 322 RMA.

Subject to the Environment Court's discretion, an enforcement order may be made against the mining company or the land-owner/occupier requiring action to remedy or mitigate the adverse effects on the environment.

### **2.7.2 Financial liability for long-term monitoring and maintenance**

Under the transitional regime –

- bonds and monetary deposits made under the Mining Act are not available to fund long-term monitoring and maintenance of tailings dams.
- bonds attached to water rights may be available for some post-closure monitoring and maintenance in accordance with their terms.
- local authorities have responsibility to undertake monitoring of compliance with the environmental conditions of mining licences, in place of the mines inspectors. However, there appears to be no authority for them to recover the costs of monitoring compliance from the dam owner or any other person.

Under the new regime –

- where a bond or covenant is entered into as a condition of a resource consent and is registered against the title to the affected land, that bond or covenant will bind subsequent owners of the land.
- in the event that a consent holder fails to fulfil a condition of the bond requiring work to be done, the relevant local authority may enter onto the land and complete the work, the cost of the work being recoverable from the land-owner. Where the owner does not pay or there is a shortfall in payment, the outstanding sum becomes a debt due to the consent authority and a charge on the land.

Whenever the dam was constructed –

- the Building Act imposes responsibility for maintaining the safety of dams on the owner of the land upon which the dam is situated. Where the territorial authority undertakes the necessary work on the dam to ensure its safety, it may charge the cost of the work to the owner of the land and if necessary the cost becomes a charge on the land. The land-owner is liable to fund the maintenance of the dam. The land-owner may be the Crown, the mining company, or any other person.

### **Dam Safety**

### **2.7.3 Effect of proposed legislation**

Land-owners will remain primarily responsible for the safety of dams on their property.

Dams classified as of high or medium potential impact will require a compliance schedule (providing for periodic inspection and consequential work), and an emergency action plan. The owner of the dam will be required to provide an annual warrant of fitness. A low-impact dam will not require a compliance schedule.

The existing tailings dams are currently classified as of low potential impact as the criteria for assigning hazard classification to dams do not give sufficient weight to potential adverse effects on the environment.

Regional councils will be able to serve notices to rectify where a dam does not comply with its compliance schedule.

In the absence of actual dam failure, the proposed dam safety legislation does not address all the long-term environmental risks posed by leachate from tailings dams

The proposed dam safety legislation does not impose an express requirement to consider the location of tailings dams.

### **Contaminated sites**

Where there is a long-term risk to the environment of acid leachate from a tailings dam or of dam failure, which could result in contamination of ground or surface water, tailings dams are likely to fall within the definition of ‘contaminated site’ which is set out in the current proposal for legislation.

Once a contaminated site has been cleaned up to the required standard (including where it is impractical to clean up completely, but the contaminants are effectively contained), ongoing monitoring and maintenance by the land-owner and ongoing monitoring by the local

authorities will continue to be necessary, although the proposed legislation does not address this issue. The persons who will be liable to clean up a contaminated site under the proposed legislation will, by implication, also be responsible for ongoing monitoring and maintenance.

As the current proposal has signalled an innocent land-owner/occupier defence to liability for the clean-up of a contaminated site, there remains a gap in the system where such defence is proven and also where a liable land-owner/occupier is impecunious or unwilling to address the problem. It is for the Government to decide how clean-up and later monitoring and maintenance should be funded and implemented in the case of such sites.

The contaminated sites legislation and the dam safety legislation will need to be consistent in their treatment of any tailings dams which are also contaminated sites.

### 3 ENVIRONMENTAL EFFECTS

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The meaning of ‘effect’ in the Resource Management Act 1991 (section 3) includes, among other things, temporary or permanent effects; past, present or future effects; cumulative effects arising over time; any potential effect of high probability; and any potential effect of low probability which has a high potential impact. This meaning introduces concepts of **risk** and **uncertainty** into matters which need to be considered when assessing environmental effects of an activity. In relation to tailings dams, risk includes the potential for structural damage to the dam and catastrophic failure due to natural hazards, human influence or both, leading to the discharge of tailings from the dam, contamination of surrounding land and water, and risk to people, livestock and property downstream. It also includes the potential for environmental contamination by leachate (eg, effects of the seepage of acid mine drainage into water) due to the characteristics of the rock and the biological enhancement of sulphur oxidation which occurs in waste rock. Uncertainties include unpredictable natural hazard events, and the onset, rate and duration of acid generation in tailings and waste rock stacks. Poor design, siting, construction and maintenance of the dam or underdrainage systems, and lack of water treatment facilities contribute to potential adverse effects.

Other significant matters that need to be taken into account include restrictions on the future use of land used for tailings disposal, and the potential impacts of tailings dams on Maori values and relationships with the land, water and waterways, and on the role and responsibilities of tangata whenua as traditional kaitiaki (guardians) of the land and natural resources (ss 6(e) and 7 RMA).

Processing ore involves using cyanide to leach the gold and silver after the ore has been ground and mixed with water and lime. The metals are then adsorbed onto activated carbon from which gold and silver are chemically stripped and recovered.

#### 3.1 Tailings and their disposal

Waste materials from the processing plant consist of fine-grained tailings in a semi-fluid state (slurry). The slurry may be either deposited underground, into open pits or, more commonly, impounded behind a retaining structure where eventually solids settle and compact. Water in the tailings pond is decanted off the surface and usually recycled through the ore-processing plant. In modern mines, excess water from the tailings dam, along with seepage collected by an underdrainage system beneath the dam, is treated before being discharged.

The chemical composition of tailings depends on the composition of the ore, the chemicals added during the gold recovery process, and metals leached from the mineralised zones as a result of contact with acid formed by oxidation of pyrite. In the short term, leachate quality will be determined by any residues of processing chemicals, such as cyanide. In the long term, the geochemical characteristics of the tailings solids (ie, their acid-producing potential) and biological enhancement of the oxidation process will be more important determinants of the potential impact of tailings on the environment. The latter process may occur over 20 to 30 years and is difficult to control.

The other type of solid waste produced by mining operations is waste rock - the material removed to get to the ore-bearing rock. Some waste rock from the mine may be used to construct the tailings impoundment. Waste rock is classified according to its suitability for use as a structural material and also according to the degree to which it has oxidised. Depending on the geological characteristics of the area being mined, waste rock and tailings may contain sulphide-bearing minerals which, in contact with air and water, react to form sulphuric acid, leading to acid mine drainage. Waste rock and tailings must be enclosed within low-permeability, fully oxidised rock and sealed to prevent or limit acid conditions arising. Generally, any potentially acid-forming rock should be sealed with non-acid-forming rock to exclude exposure to atmospheric oxygen. Deposited tailings will consolidate (become more solid) over time, allowing capping to be placed over them. The finer tailings which are less compacted may retain a water cover that prevents oxidation occurring.

### **3.1.1 Options for disposing of tailings**

In the past, when underground mining was the more common method of extracting gold-bearing ore, the relatively smaller amounts of tailings were discharged directly on to land or into streams. In contrast, today's open-pit mining produces large quantities of waste rock and tailings and operators look for disposal sites that are as close to the milling process as possible. This restricts the options to either constructing a purpose-built tailings impoundment or returning the tailings to the open pit or underground workings for disposal, or both. Both methods are used worldwide and both have practical advantages and disadvantages.

The difficulty in disposing of waste rock and tailings to the area mined is the increased volume of materials to be deposited. This will exceed the space available in open pits and underground workings, so a separate disposal site is inevitable. Care is also required when disposing of waste materials in either open pits or tailings impoundments to avoid contaminating the groundwater by processing chemicals or acid leachate.

Suitable options for disposing of waste rock and tailings need to be decided on a case-by-case basis, taking into account the acid-producing potential of the mining wastes and the assessment of environmental effects (including long-term effects) of the disposal options.

Mine waste management is primarily a water management problem. In the long term, the control of acid mine drainage is a critical issue. Chemical reactions giving rise to acid mine drainage are known to last for long periods, in some cases several hundred years (Klohn, 1995). The rate and extent of acid generation depend primarily on the geochemical and physical nature of the rock, and the physical and climatic conditions at the site. The oxidation of sulphides is a natural geochemical process, but mining operations increase the exposure of acid-generating surfaces to air and water, thereby accelerating the rate of acidification relative to natural processes.

### **3.2 Environmental effects**

A report by the US Environmental Protection Agency Office of Solid Waste (US EPA, 1995) examined 66 cases of damage caused by wastes from mining and mineral-processing operations resulting in human health and environmental impacts. About 40 percent of these involved see page's or runoff from tailings disposal. In the cases studied, the most significant types of impacts were contamination of surface water, groundwater and soil.

Acid drainage and leaching of metals can be generated from the oxidation of any exposed sulphide-bearing rock surfaces in a mining operation - open pit and underground mine workings, tailings impoundments, rock piles and any facilities (eg embankments) constructed from acid generating material. The oxidation products are flushed from these areas to the receiving environment by natural precipitation, surface water and groundwater. Drainage water contaminated by oxidation and leaching processes affects receiving water quality and is toxic to aquatic biota. The spiritual significance of water and waterways to Maori means that any contamination will pose particular problems for tangata whenua (refer to chapter 5.3 below).

It is necessary to minimise the quantity of water escaping from the tailings dam to avoid environmental contamination, and it is good environmental management practice. This can be achieved by recirculating process water and controlling seepage. Measures used to control seepage from a tailings dam might include:

- use of clay liners and synthetic liners;
- foundation grouting and the use of cut-off trenches;
- controlled placement of tailings; and
- inclusion of toe drains and underdrains to collect and treat or recycle seepage.

(Australian Environment Protection Agency, 1995)

Other measures include ‘beaching’ of tailings (ie, depositing them against the embankment of the tailings dam) to minimise the amount of free water against the embankment face, and reducing the quantity of water within the tailings impoundment.

As acid drainage migrates through mineralised materials, additional acid can be generated, causing a further reduction in pH and increased leaching of metals such as lead, zinc and cadmium which may cause further environmental contamination. Conversely, if the drainage passes over alkaline material it may be partly neutralised. Biological activity (oxidising bacteria) along the route of migration may accelerate acid drainage, whereas a wetland area may remove metals from the effluent and lower its pH (Ontario Ministry of Northern Development and Mines, 1991).

The fate of cyanide in the tailings is complex. When used during processing of the ore, cyanide is subject to variable decay and breakdown to cyanate and ammonia, and absorption into the tailings solids. Further decay, breakdown and volatilisation occurs in the tailings impoundment. For example, the fate of cyanide in the tailings dam depends to some extent on the pH of the tailings. As the pH of the tailings decreases (ie, they become more acidic), most of the free cyanide is discharged as hydrogen cyanide gas (Cyprus Minerals, 1987).

**3.3 Environmental risks** Tailings dams present two significant types of long-term environmental risks (ie the potential to cause environmental damage): the risk of the dam structure failing, and the risk of pollution.

**3.3.1 Failure of the dam structure** The probability of this occurring may be low, but the consequences may be disastrous for local communities and the downstream environment. The risk posed by any particular tailings dam will be site specific depending on, for example, the design, construction and maintenance of the dam, the characteristics of underlying rock, rainfall and seismic activity in the area, and the extent to which the tailings have compacted (ie, become more solid than semi-fluid).

In May 1996, the United Nations Environment Programme (UNEP) published the results of a survey of environmental and safety incidents concerning tailings dams at mines. The survey covered the years 1980-1996 and was based on information provided by government agencies around the world, supplemented with information from the *Mining Journal* files. The survey, while incomplete, is considered indicative of the situation. It identified fewer than ten major failures having been reported in the survey period. Virtually all failures occurred as a result

of the presence of water. This may have resulted from percolation through the dam wall, internal erosion, overtopping or flooding, and been exacerbated by natural phenomena such as earthquakes or persistent heavy rainfall. The majority of incidents were attributed to natural processes which may have triggered the collapse of weakened structures. Some effects of the failures included loss of life, damage to property, groundwater contamination, dust emissions and disturbance of wildlife habitat. A major concern in the report was that while the design may have been adequate, construction was not always according to specifications. Consequently, the report suggests that further improvements in design, construction and operating practice should reduce the risks of major incidents in the future (International Council on Metals and the Environment, 1997).

### 3.3.2 Pollution

Pollution may arise from acid mine drainage, heavy metals and cyanide seeping into groundwater, waterways and land. The long-term risk of acid mine drainage arises when there is a net acid-producing potential in the tailings mass. This risk depends on the chemical composition of the tailings, the dam's drainage systems, access to water treatment facilities, and how the dam is closed off (capped) at the end of the operating phase. Pollution may also result from dust from dried-out tailings.

Whereas some risks will increase over time, others will decrease or remain the same. Natural events, such as floods, earthquakes or land slips add to the long-term risks (the probability of adverse effects) and uncertainties (about predicted effects and the effectiveness of rehabilitation). Identifying the combination of factors that contribute to risk is important when considering any long-term risk management strategy for a tailings dam.

According to New Zealand's Dam Safety Guidelines (NZSOLD, 1995), effective and ongoing operation, maintenance and surveillance procedures are essential to ensure the continued viability and safety of a dam; the cost of the procedures is small in relation to the consequences of dam failure or damage caused by seepage of contaminants. The guidelines categorise dam hazards into 'low', 'significant' and 'high'. Factors which can affect hazard potential include the dam's height, the volume of material stored behind the dam, the nature of the stored material, and the geological and climatic features of the area in which the dam is located. The guidelines suggest that the frequency of inspections of dams should be based on their hazard category. For example, routine inspections of high-hazard dams should be carried out weekly to monthly, compared to low-hazard dams which only require monthly to four-monthly inspections.

## 3.4 Environmental monitoring

Factors that need to be considered when designing a monitoring network for discharges from tailings dams include:

- baseline and background conditions;
- waste characteristics;
- the degree and nature of tailings containment;
- the disposal environment (climate and local geological, hydrogeologic and geochemical conditions);
- potential migration pathways and likely migration times; and
- potential effects of leachate.

(Australian Environment Protection Agency, 1995)

There are constructive opportunities for the involvement of tangata whenua in ongoing monitoring work. Useful traditional and local knowledge about the site and general environmental conditions could be integrated into the project. The potential for tangata whenua participation in monitoring has been noted by one iwi (Ngati Tamatera) as part of a wider information and assessment regime that would bring together the skills and expertise of Maori, scientists, environmental groups and public authorities. This would give practical effect to the role and responsibilities of kaitiakitanga (traditional guardianship of the land and natural resources), as provided for under s 7(a) of the RMA.

**3.5 Summary** Tailings dams can cause a number of short- and long-term environmental effects if they are not well designed and managed. These problems usually relate to surface and groundwater contamination, dam safety and stability, and long-term management problems associated with poor rehabilitation and restoration of the area and with potential damage caused by natural hazards.

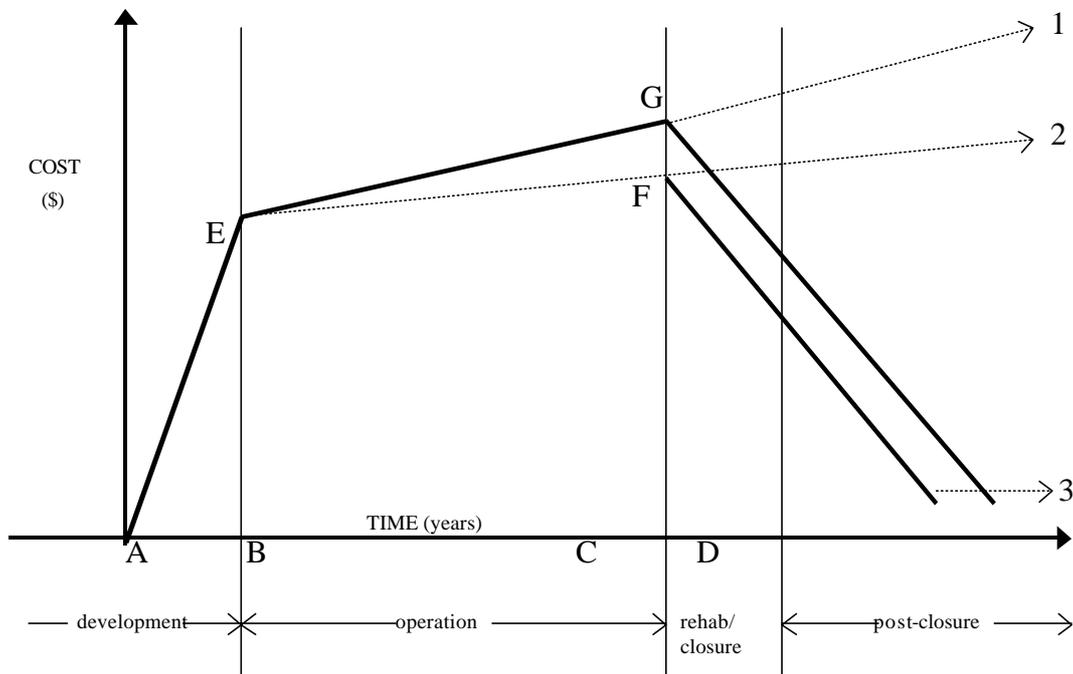
## **4 STAGES IN THE MANAGEMENT OF TAILINGS DAMS**

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This chapter outlines the various stages of mine management which ultimately affect the long-term management of tailings dams.

Mines with tailings dams pass through at least four distinct management phases – development, operation, rehabilitation/closure and post closure. Figure 1 illustrates these phases and the changes in the cost of rehabilitation and long-term management over the life of a mine site. It shows how continuing costs, such as those of monitoring and maintenance in the post-closure phase, may vary depending on the adequacy of rehabilitation at the time of closure.

**Figure 1 Mine Stages and Potential Rehabilitation Costs**  
(adapted from Ontario Ministry of Northern Development and Mines, 1991)



This figure illustrates the potential average costs over time of rehabilitation and post-closure management of mining sites containing tailings dams.

- Start date, A, is the date when the first site disturbance and preparation for mining begins.
- The **development phase**, AB, is the period leading up to the start of mining operations.
- The **operation phase**, BC, is the period after site development when extraction of the ore and minerals takes place and tailings are impounded. Cessation of mining and tailings disposal occurs at C.
- During the **rehabilitation/closure phase**, CD, rehabilitation is carried out in preparation for closure of the mine site at D.
- In the **post-closure phase**, rehabilitation works continue until the consent authority is satisfied that the closure plan, and relevant consent conditions, have been complied with. Maintenance of tailings dams and monitoring of their environmental effects may continue for an indefinite period.

At the start of the mining operations there will be an obligation to rehabilitate the site at point E. If no progressive rehabilitation is carried out throughout the operational period, the cost of rehabilitating the site will increase to point G when operations cease. If progressive rehabilitation is carried out during the operational period, represented by the line EF, the cost to rehabilitate the site will be reduced to point F.

There are three levels of potential cost in the post-closure phase, depending on the extent and success of rehabilitation. These are illustrated in the figure as:

- 1 Costs of rehabilitation, monitoring and maintenance of the site will continue to increase if no rehabilitation takes place before or at closure.
- 2 Increasing but slightly lower ongoing costs will occur if progressive rehabilitation takes place during the operational phase, but no further rehabilitation is carried out during closure.
- 3 Ongoing post-closure costs (monitoring and maintenance) will be lower if rehabilitation is carried out during closure.

## 4.1 Development

This phase includes site selection, investigation, design and construction of tailings disposal facilities, installation of stormwater drains to divert water away from the dam, and installation of underdrainage to remove leachate from the dam. Many decisions at this crucial stage will determine to a large extent the potential long-term environmental effects of the tailings dam. For example, the stability of the site and its general suitability as a location which can reliably contain tailings in perpetuity is as important, if not more so, as locating the tailings dam close to the ore body. Planning for the operation and, particularly, the close-out stages of the facilities are important matters that need to be addressed during the mine development period. Consultation with tangata whenua will be an essential part of the planning process, to ensure recognition and integration of the values and knowledge of iwi and hapu, and appropriate understanding of the traditional and spiritual significance of the proposed site and associated waterways.

Three main objectives are commonly considered in designing and constructing containment structures for tailings. Firstly, the tailings must be contained in a structure that will be effective in perpetuity. In other words, the design, construction and maintenance of the dam should ensure minimal risk from structural failure, leakage and erosion leading to adverse effects on the environment. Secondly, the groundwater resources of an area around the containment must be protected from contamination by tailings or any leachates arising from the tailings. Thirdly, the design should ensure that only minimal maintenance of the containment facility is needed after the operational phase of the mine is completed (Waggitt, 1994).

## 4.2 Operation

During this period, tailings are deposited. During the mine operation phase, the chemistry of the tailings and associated settling pond are largely controlled by the milling process. Any water discharges from the mine are required to be monitored and, if necessary, treated before being discharged to surface water or land.

There have been advances in the methods of predicting, treating and preventing acid generation during the operation phase, and the treatment of established acid mine drainage during the rehabilitation phase. These include alkali addition to tailings, surface covers including clay and synthetics, sulphide removal, water covers, and wetlands treatment. The applicability and effectiveness of any technology is dependent, among other things, on the local climate, the extent of toxicity of the tailings, the extent of tailings consolidation, drainage through the impoundment, the availability of suitable material for capping and the amount of topsoil available (Welch, 1991; Knapp, 1991; Queensland Department of Minerals and Energy, 1993). For large-scale tailings dams containing material of high acid-producing potential the only long-term management option may be to ensure that the tailings remain securely impounded, and sealed to prevent oxidation. Failure to

achieve and maintain this may result in perpetual environmental contamination.

Management of acid-generating waste rock dumps is also important. Matters to consider include siting, drainage collection, placement practice, and decommissioning covers to inhibit stormwater infiltration and access for oxygen. A waste rock dump at an open-pit mine can be a much greater problem, in terms of acid mine drainage, than tailings because the volume of rock is greater and oxidation can occur more easily in the open pore spaces of the waste rock. The exposed pit walls may also be a major source of acid mine drainage if the pit is not permanently flooded after the operational phase.

### **4.3 Rehabilitation /decommissioning**

This period includes all activities to prepare the facility for closure and future land use, in accordance with conditions in the mining licence. Mining equipment and structures are removed and work is often required to re-establish surface drainage patterns. Planting and regrading of exposed rock surfaces is carried out. Monitoring and treatment of groundwater and surface water discharges continues during this phase.

In some jurisdictions (Queensland Department of Minerals and Energy, 1993) a tailings dam is considered decommissioned if stormwater runoff can pass through or around the dam without creating a substantial pond or without eroding any of the materials deposited within the impoundment or of which the dam itself is constructed. The dam structure is expected to be left in a stable condition with no erodible faces on any exposed embankment slopes. In Queensland, as part of a mine's decommissioning, an evaluation is needed of the following matters:

- potential risks to the safety of people, property and the environment, and any liability to current and future owners due to contamination;
- conditions in the consents relating to closure; and
- the long-term monitoring and maintenance requirements.

Matters that have to be considered in a decommissioning programme include:

- documentation of the site history, including details of ownership of the land during mine operations and after closure;
- information on the significance of the site and associated waterways to the tangata whenua;
- the stated views, concerns and priorities of the tangata whenua as kaitiaki (guardians) for the site and associated waterways;
- relevant local and traditional knowledge about the area, the specific site and associated waterways, and environmental conditions generally;

- details of tailings dam construction and drainage, including changes to the design of the dam during its use;
- details of the treatment of the tailings dam (eg, dry capping or flooding);
- instrumentation required to determine whether the structure is performing according to the design, eg, the measurement of settlement, pore pressure and seepage;
- records of monitoring programmes, including the chemical composition of the tailings, the structural stability of the dam and the quality of runoff and groundwater;
- final closure/decommissioning plans, including details of continued monitoring and maintenance programmes;
- details of rehabilitation measures undertaken and to be completed; and
- measures to prevent public access to the tailings dam site.

Guidelines published by the Ontario Ministry of Northern Development and Mines (1991) categorise rehabilitation into:

- a **walk-away** solution in which no additional monitoring or maintenance are required after rehabilitation is completed;
- **passive care** when there is some continued need for occasional monitoring and infrequent minor maintenance to non-critical structures; and
- **active care** in situations where annual continued monitoring and maintenance is required. This would typically apply to the collection and treatment of acid drainage, and would require the development of an operational plan and management structure.

The relevant category is determined on a case-by-case basis, and a project can only be ‘closed out’ (verification given that all rehabilitation requirements have been met) if rehabilitation work can achieve a ‘walk-away’ or ‘passive care’ solution.

‘Close-out’ is the objective of rehabilitation which the mining licence holder strives to achieve. It is the point at which the consent authority determines whether the rehabilitation conditions of the mining licence have been complied with and the bond or deposit can be released entirely or in part.

#### 4.4 Closure

A closure plan prepared prior to this stage should address the long-term physical and chemical stability and land-use issues associated with the components left behind at the site as a consequence of mining operations, including open-pit excavations, rock and overburden piles, and tailings impoundments.

As part of the closure plan for the mine, it is important to consider whether the tailings dam is able to remain:

- non-polluting;
- structurally stable;
- resistant to erosion;
- visually compatible with surrounding landforms; and
- functionally compatible with the agreed post-mining land use.

If resource consents are required to implement the closure plan, applications for consents will need to be submitted well in advance of closure and be accompanied by an assessment of environmental effects.

Ideally, a long-term, post-closure management plan would be prepared, before or during the preparations for closure, as part of any resource consent application. This would identify how any post-closure environmental effects are to be addressed. At this stage consideration also needs to be given to post-closure emergency action plans and procedures. New arrangements have to identify who will take responsibility for monitoring critical areas and giving advance warning, when necessary, to evacuate the downstream area in the event of a possible breach of the dam.

#### **4.4.1 Closure and future mining prospects**

One of the issues that arises at the closure phase is the question of when a mine actually closes. It may close at the expiry of a mining licence, but reopen if a new permit is applied for and approved. It is possible that at some time in the future it may become financially viable to reopen the mine or to reprocess the tailings. This leads to the possibility that mining on the site, including the tailings disposal area, may not permanently end and that the site could be designated as one which has the potential to be mined again. This will have some effect on decisions relating to where and how tailings will be disposed of, and how a tailings dam is to be rehabilitated.

General rules relating to rehabilitation/restoration and mine closure may be best dealt with in regional and district plans, but site-specific risks need to be managed through site-specific consents. A mining operation may end at the expiry of the mining licence, but if the site still has potential for mineral recovery in the period after the licence expires, the mine may be more appropriately described as being 'dormant' and would require an appropriate maintenance programme to be developed. Such a programme needs to balance the opportunities for future mineral recovery against the importance of properly capping or sealing the tailings to reduce the potential for acid mine drainage to occur. The rehabilitation requirements of the licence conditions still need to be fulfilled to guard against future adverse effects on the environment. Closure plans need to address these issues. Some options for disposing of tailings, such as putting them back into the area mined, effectively close off the possibility of mining the area again at a later date.

Long-term monitoring programmes should be implemented at this stage. The post-closure period during which monitoring and maintenance needs to be carried out will be site-specific. It depends on the potential for acid drainage to occur and how effective the rehabilitation has been in minimising this potential. Post-closure monitoring may be necessary until the land-owner/occupier can demonstrate that the site is safe, stable and meeting selected performance criteria in resource consents or regional plans, for example. In some cases this may be achieved within about 10 to 20 years after rehabilitation, after which the frequency and type of monitoring may be able to be scaled down. In others, provisions may have to be made for environmental monitoring and dam maintenance to be carried out indefinitely, depending on the risks to the environment created by the tailings dam.

## **4.5 Post-closure**

Surface and subsurface seepage of contaminants, weathering of construction materials, plugging of filters and drains, and ability of the dams to withstand earthquakes, floods, and water and wind erosion are all hazards that need to be considered in the long term (Klohn, 1995). Care must also be taken to ensure that vegetation, fencing or other structures do not cause damage to a rehabilitated surface and jeopardise the integrity of the tailings dam structure.

Periodic maintenance and repair of structures, drains and treatment plants may be necessary, and expertise may have to be called upon to ensure that adverse environmental effects do not occur. Monitoring bores around the tailings impoundment site can provide information on the level, pressure and quality of groundwater. Geophysical surveys carried out around an impoundment measure the conductivity of the subsurface formations. The presence of mineralised groundwater may be indicated by high conductivity readings.

Effective long-term management of tailings and tailings dams depends on a number of considerations at the various mine stages. Some key considerations may be relevant to more than one stage.

## **4.6 Disposal and long-term management of tailings**

## **Development (and pre-development) phase**

Considerations include:

- identifying and assessing alternative options (methods and sites) for disposing of tailings, having regard (post-1991) to the sustainable management of natural and physical resources, and the control of adverse effects on the environment;
- knowledge of the geological, geochemical and hydrological characteristics of the area in which the tailings facility is located;
- the history and predicted frequency of natural hazard events;
- the design and construction of the tailings storage facility, having regard to the need to impound tailings in perpetuity;
- the significance of the site and associated waterways to the tangata whenua, and the views, concerns and priorities of iwi and hapu.

## **Operation phase**

Considerations include:

- the construction and maintenance of the embankments enclosing the tailings;
- the feasibility of carrying out repairs if a structural defect occurs before the tailings have consolidated, or after the occurrence of a natural hazard;
- the nature of the tailings, especially whether they remain 'liquid' or have the potential to liquefy in the event of an earthquake or dam breach;
- the maintenance of surface and subsurface drainage systems;
- the maintenance and effectiveness of water treatment facilities.

## **Rehabilitation/closure phase**

Considerations include:

- whether, in particular cases, relocating tailings is feasible and offers the best long-term solution to dealing with actual or potential adverse effects on the environment;
- the technical difficulties, cost and environmental effects of disturbing and removing the tailings, and restoring the land on which the tailings dam was located if, due to unforeseen circumstances, it is necessary to shift the tailings;
- the consequences, if any, on structural stability if some or all of the tailings are to be relocated;
- whether options for rehabilitating or remediating the site are limited or non-existent;
- methods of rehabilitation and proposals for future land use, and whether such proposals are consistent with the principle of sustainable management of natural and physical resources, whether

they take into account the principles of the Treaty of Waitangi and the views, concerns and priorities of the tangata whenua, and avoid future adverse effects on the environment.

### **Post-closure phase**

Considerations include:

- whether a ‘maintenance-free’ tailings dam (ie a ‘walk-away or ‘passive care’ solution) is achievable and will continue to be so in perpetuity;
- the need for regular checks to verify predictions about the stability of the dam structure and the quality of the leachate in the long term;
- the effectiveness of long-term monitoring and the ability of such monitoring to detect potential acute problems;
- access (and cost) of any expert advice and consultation with tangata whenua needed throughout the life of the tailings dam;
- the willingness of the land-owner to take immediate action to avoid, remedy or mitigate any adverse effects on the environment; and
- the provision of adequate financial resources by the land-owner or occupier to monitor and undertake maintenance and repairs on a long-term basis;
- the extent and duration of any necessary monitoring and maintenance regime.



## 5 ENVIRONMENTAL LIABILITY

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This chapter examines some issues associated with liability for rehabilitation and long-term management of any environmental effects of existing tailings dams. In the context of this report, ‘environmental liability’ refers to the legal responsibility for meeting statutory obligations including the costs of rehabilitating a mine site, and any subsequent long-term care required after mine closure.

The chapter also discusses issues which are of particular concern to iwi, and addresses the question of whether future mining operations could be declared prohibited activities.

Existing legislation makes it clear that liability for rehabilitating a mine site rests with the licence or permit holder, and licence or permit conditions usually require the holder to rehabilitate the site to a prescribed standard that takes into account safety issues and effects on the environment. Effective rehabilitation of the site at closure will also help to reduce the ongoing costs of post-closure care and maintenance. In New Zealand, as in other countries, when monetary deposits or bonds are taken from the mining company they are not intended to fund rehabilitation of the site by that company. The purpose of these deposits and bonds is strictly that of security against non-performance by the mining company of final and comprehensive rehabilitation. These deposits and bonds are designed as an alternative source of funding for the public authority to carry out the entire task of rehabilitation if the licence or permit holder defaults.

### 5.1 Rehabilitation costs

Problems can arise if the holder:

- abandons the site, for example due to bankruptcy, leaving rehabilitation of the site incomplete; or
- carries out rehabilitation but, after closure and/or sale of the site, unforeseen environmental contamination or safety issues arise.

Although the bond or monetary deposit set aside at the time of granting the mining licence may take care of the first situation, the second example is more problematic if at the time of closure the licence or permit holder is released from the bond and ownership of the land subsequently changes. The new land-owner may then become responsible for the clean-up of any environmental damage or structural repairs and any necessary continued monitoring and maintenance.

A number of issues relating to the determination of the present value of future rehabilitation and long-term management costs need to be

considered early in the mine project and revised towards the end of the operation phase. These include:

- the cost if rehabilitation work had to be started immediately (eg, following a decision to close the mine earlier than anticipated);
- the cost of sudden and unforeseen events now and in the future;
- costs of monitoring environmental effects and maintaining treatment plants, drainage systems and other essential equipment after closure;
- the costs at the estimated time of closure, and the factors that may alter the closing date such as more efficient gold recovery techniques, falling prices and other factors;
- the effect of inflation on costs;
- the interest rate used in discounting future costs;
- the valuation assumptions, who approves them, and when and how often they are revised; and
- the potential increase in the cost of rehabilitation, and post-closure monitoring and maintenance, if rehabilitation is not carried out to a satisfactory level before and after closure (see figure 1). If the licence holder fails to comply with rehabilitation requirements, this increased cost may not be fully covered by the bond.

Consent authorities need to regularly review the bond or deposit to assess whether, at any particular stage of the operation, it is adequate to meet the costs of rehabilitation if the licence holder fails to do so. It is likely to be more costly for a local authority to do the necessary work than it would be for the mining company because the authority would need to employ contractors. Local authorities need to be aware of this when examining any rehabilitation cost estimates prepared by the licence holder as the basis for estimating the bond. There are constraints on reviewing the amount of the bond for existing mining operations licensed under the former Mining Act 1971. As outlined in an earlier chapter (2.1.1), this could only be done on a three-yearly basis.

## 5.2 Long-term management issues

Important long-term management issues include:

- who should take responsibility for long-term monitoring and maintenance of tailings dams after the mining licence has expired or the site has been abandoned?
- what level of monitoring and maintenance will be required in the long term?
- how should long-term monitoring and maintenance of tailings dams be funded?
- what are the views, concerns and priorities of the tangata whenua, especially in regard to potential impacts on water and waterways and the legacy that may be left for future generations?
- how are the concerns of kaitiaki to be provided for?

Local authorities have a number of monitoring duties under s 35 of the RMA, including monitoring the exercise of resource consents and monitoring the state of the environment in the region or district. Councils are able to fix charges for monitoring and supervision of resource consents (s 36(1)(c) RMA), but the transitional provisions of the Crown Minerals Act do not enable them to recover costs of monitoring compliance with environmental conditions in current mining licences.

### **5.2.1 Responsibility for long-term monitoring and maintenance**

Responsibility for monitoring environmental effects rests with the licence or consent holder. Liability for any adverse environmental effects and maintenance of the site ultimately rests with the land-owner. It is important, therefore, that land-owners and potential purchasers are aware of their long-term responsibilities for the management of environmental effects associated with the site. If a site is abandoned and becomes an 'orphan' site, the Crown assumes ownership of the land, and with ownership the Crown also assumes liability.

### **5.2.2 Level of monitoring and maintenance required in the long-term**

The type and level of monitoring needed will be site-specific and relative to the risks involved. Risks to the environment and downstream communities will vary over time. Some risks may decrease (eg, cyanide contamination, structural failure of the dam), whereas others may increase (eg, seepage of acid drainage and metal contamination), fluctuate (eg acid drainage production), or be uncertain or unpredictable over the long term (eg, damage caused by floods, land slips and earthquakes). Monitoring and maintenance requirements are, therefore, likely to vary over time making it difficult to accurately predict the resources required.

One of the deficiencies in the present system of environmental liability is that there are no provisions in the transitional arrangements of the Crown Minerals Act that require existing mining licence holders to meet the costs of post-closure, long-term management of environmental risks from their tailings dams. Nor is there a system which determines, as far as possible, the costs of future post-closure monitoring and maintenance, bills this cost to the operating mining company during the years of mining, and utilises the funds to carry out any necessary post-closure work.

### **5.2.3 Funding of long-term monitoring and maintenance**

Future mining projects may be liable for post-closure management costs (see chapter 2.3.2).

Revenue to the Crown from the extraction of Crown-owned minerals is not available to assist local authorities in remedying environmental damage caused by a mining company abandoning its site. This is

unlikely to change unless the policy for collecting any royalties or fees is revised to include the establishment of a contingency fund to manage abandoned sites that have not been adequately rehabilitated and for which a bond or deposit was not required (the Tui mine in Appendix 1 is an example of this).

After rehabilitation, the level of funding required for continued monitoring and maintenance will vary over time depending on how effective the rehabilitation has been and the measures in place to manage residual risks associated with acid drainage and the structural safety of the dam. One incentive for mining companies to adequately rehabilitate the site, and thereby minimise the amount of long-term maintenance likely to be necessary, is to be released from the bond or to have any monetary deposit returned by the public authorities at the closure of the site. Other incentives, consistent with the ‘polluter pays’ principle, need to be explored.

The United States Code, Title 40 (1995) is one example of a system developed to ensure that an operator provides financial assurance for post-closure care of hazardous waste facilities (see chapter 6.2.2). However, post-closure financial assurance should not be regarded as a substitute for proper rehabilitation. Funding for both rehabilitation and post-closure care needs to be provided for by the licence or consent holder.

Like fluctuating prices of commodities associated with any industry, the volatility of metal prices poses a perpetual concern to the mining industry and consent authorities responsible for controlling environmental effects. Increased financial pressure could put any post-closure monitoring and maintenance plans in jeopardy unless funds had been collected specifically for this purpose throughout the operation phase of the mine.

### **5.3 Issues of concern to iwi and hapu**

The environmental effects associated with impounding tailings give rise to some particular issues of concern to iwi and hapu. These issues will potentially affect both the tangata whenua of the specific area where the tailings dam is sited, and the people of downstream areas. The major issues which need to be taken into consideration are discussed briefly below, and noted elsewhere through this report.

#### **5.3.1 Statutory Provisions**

The Resource Management Act requires that ‘the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu and other taonga’ be recognised and provided for as matters of national importance (s 6(e)). The RMA also requires decision-makers and

managers to have particular regard to kaitiakitanga (s 7(a)) and to take into account the principles of the Treaty of Waitangi (s 8).

These legislative requirements mean that the impacts and potential impacts of tailings disposal must be considered from the perspectives of the tangata whenua as kaitiaki (guardians) of the land and natural taonga (valued resources). The responsibilities of kaitiaki include caring not only for the physical resource but also for the intangible spiritual and ancestral dimensions, the mauri (life force) of the resource. These traditional obligations are still strongly felt by tangata whenua even when the formal ownership of the land has passed to others. The kaitiaki role is a fundamental aspect of the expression of tino rangatiratanga (self-determination), as confirmed under Article II of the Treaty of Waitangi.

In the implementation of the RMA, these statutory requirements will be given practical effect through such means as consultation with the iwi and hapu concerned, their participation as appropriate, and the recognition and integration of their concerns and priorities, at all stages from the outset of the project, within the wider frameworks established by the relevant council(s).

There are several ways in which tailings dams and **5.3.2 Values** their various effects might have an impact upon the values of tangata whenua, including:

- disturbance of waahi tapu or waahi taonga;
- land disturbance and restrictions on the future use of land – of particular concern where there may be a claim for land to the Waitangi Tribunal;
- ground and surface water pollution;
- impacts on cultural and spiritual values; and
- impacts on the interests of future generations.

The potential location of tailings dams on waahi tapu or waahi taonga (sacred or traditional sites) is a serious concern, whether places of historical significance such as battle-grounds or residential sites, urupa (burial sites), or other places of importance to tangata whenua.

The significance of water is also particularly relevant. In the Maori world view, water is more than just a physical resource, but has a vital mauri (life force) of its own. Furthermore rivers, streams, lakes, wetlands and other waterways have especial significance. They are important as mahinga kai (traditional food-gathering places). They are also the living manifestation of ancestors and gods in the landscape, with the ancestors' spirits mingling and moving through the water currents. Thus waterways are essential features in whakapapa (genealogy and tribal identity). If the mauri of a waterway is harmed, for example through pollution, the spiritual impacts can be extensive.

Restoration of the physical dimensions will not necessarily resolve the spiritual damage.

**5.3.3 Consultation** Consultation with iwi and hapu will be critical to ensure that local interests are properly addressed and that practical effect is given to the principles of the Treaty. Effective consultation with iwi and hapu by the consent authorities, and the consent applicants and holders, on a case-by-case basis, will benefit all the parties involved and help to ensure that appropriate measures are incorporated into the siting, design, construction, monitoring and maintenance of tailings dams. Consultation is particularly important at the consent application stage, but is also an important consideration in the development and implementation of site-specific closure plans and post-closure monitoring and maintenance arrangements. Adequate funding and time-frames for consultation with tangata whenua, and for their participation as required, will need to be planned for.

**5.3.4 Knowledge** There is concern in some areas that local knowledge, values and expertise are being overlooked in favour of technical expertise, often brought in at great expense from overseas (P Williams, Ngati Tamatera, pers comm). This has occurred with regard to decision-making on the suitability of particular sites for locating tailings dams, as well as methods for managing their effects on the environment. The relevance and usefulness of traditional knowledge handed down over the generations about a particular area, site or suite of environmental conditions, should not be lost simply because of academic assumptions about the value of such information. This applies equally to the accumulated local knowledge of non-Maori residents.

Care must be taken to respect the sensitivity and confidentiality of some information held by iwi and hapu, in particular the precise location of waahi tapu sites, or specific information about their history and significance. Such situations will need to be dealt with carefully through the consultation process and the appropriate involvement of all consent authorities and decision-makers.

**5.4 Mining as a prohibited activity** A bill ('Sulfide Mining Moratorium Bill') currently before the legislature of the US State of Wisconsin seeks to effectively prohibit the opening of any new mine in a sulphide ore body. The proposal places the onus of proof on the applicants for a mining licence to show evidence that a mine similar to the one proposed has operated elsewhere for at least 10 years without significant environmental damage, particularly from acid drainage pollution.

In New Zealand, councils are able to declare certain activities prohibited in their regions or districts. Under the Resource Management Act a regional council or territorial authority can make rules in their plans which, among other things, may prohibit activities. In making such rules, councils have to have regard to the actual or potential effect on the environment of the activities including, in particular, any adverse effect (sections 68(1)(b) & (3), and 76(1)(b) and (3)). This option could be used to prohibit any future mining operations if councils decide that it is the most appropriate approach to take to control adverse effects on the environment from these activities. Any such proposal would need to involve consultation with the community, the mining industry and other interested parties.



## 6 LONG-TERM RISK MANAGEMENT OPTIONS

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Previous sections identified some of the major issues in the post-closure, long-term management of environmental effects of tailings dams. This chapter examines a number of options for addressing those issues, from two perspectives: risk assessment and management, and funding.

As with many other industrial activities, mining generates risks and associated costs to the environment and to regulatory authorities responsible for managing environmental effects. The scale of the activity and its potential to cause environmental damage affect the level of risk and the cost of remedial measures. The magnitude of post-closure long-term management costs of tailings dams will largely depend on the chemical nature of the rock, the design and construction of the tailings dam and the effectiveness of rehabilitation by the licence holder.

### 6.1 A risk-based approach to long-term management

Risks are highest where the site is prone to acid drainage and the licence holder fails to complete the required rehabilitation works. In this case, if the bond or other security is insufficient to cover all the costs of rehabilitation (eg, due to unforeseen events occurring during the operational phase), the long-term environmental risks will increase, as will the costs of remedial measures and long-term management of tailings dams. This in turn will result in increased long-term financial risks for the land-owner (who may or may not be the licence holder) and monitoring costs for the local authority. If the site is abandoned, financial liability for post-closure care may ultimately transfer to the Crown.

There are also benefits to be derived from the metals recovered from the mining activity, and economic benefits to the community in which the mine is located. Benefits of a mining operation to the local economy, such as employment and contracts for local service industries, continue throughout the operational and rehabilitation stages. Some of these benefits to the community may be considered short-lived compared to the potential long-term environmental risks and restrictions on future uses of land and water resources affected by a tailings dam. Some closure and rehabilitation plans may provide for recreational or other facilities intended to offset any adverse environmental effects and to benefit the community in the longer term. Examples of these include creating a lake in an open pit, or rehabilitating the tailings dam to become a wetlands reserve. Wetlands

have also been used as a method for treating acid mine drainage (Sobolewski, 1996).

These risks, costs and benefits all need to be carefully considered when processing and setting conditions on mining permits and resource consents, and reviewed regularly to take account of any change in circumstances before the mine is closed.

### **6.1.1 Assessing the long-term risks**

In the period following rehabilitation and closure of a mine, there will be some uncertainty as to whether the rehabilitation has succeeded in preventing any future environmental damage. Some residual risks associated with the tailings dam and other sources of acid mine drainage on the site may remain in perpetuity. This risk can be broken down into two components:

- risk of adverse effects on the environment; and
- risk to public authorities likely to be faced with unexpected additional clean-up and long-term monitoring costs after the mining licence expires.

#### **Environmental risks**

Mining licence holders may be required to obtain resource consents to put into effect their rehabilitation/closure plans. An assessment of effects on the environment (AEE) accompanying consent applications provides local authorities with an opportunity to identify and assess the potential long-term effects on the environment of rehabilitation and close-out options. This could be described as a residual risk assessment (RRA) enabling the consent authority to determine the necessary nature and extent of any post-closure management of the tailings dam. An RRA would also help to identify any additional rehabilitation works necessary to reduce post-closure risks and related costs.

Matters to consider in an RRA and any subsequent risk management strategy include:

- the chemical composition and the quantity of tailings being disposed;
- the acid mine drainage potential of the tailings, waste rock dumps and exposed rock faces, and how this varies over time;
- the design, construction and treatment of the tailings dam;
- the physical state of the tailings in the impoundment (ie, liquid, semi-liquid or solid);
- the suitability of underdrainage to collect seepages;
- the suitability of any water collection and treatment facilities;
- the sensitivity of the local environment to contaminants;
- the history of land stability in the area;

- the seismic activity in the area;
- the projected rehabilitation and long-term management requirements;
- the company's record of compliance with consent conditions;
- the company's financial history and strength, assets and liabilities in New Zealand;
- the company's rehabilitation track record;
- the company's closure and rehabilitation plan;
- emergency management plans and procedures for the post-closure period;
- an evaluation of the worst-case scenario (eg, the release of tailings during the post-closure period) and strategies to manage the risks identified;
- an outline of how public concerns are being and will be addressed.

A standard methodology for carrying out an RRA would ensure that the risks posed by each site are assessed in a fair and consistent manner. A risk management strategy would be site-specific.

### **Risks to local authorities**

As mentioned previously, bonds or monetary deposits, required to be set aside by mining companies by statute or consent conditions, are intended to ensure that rehabilitation will be carried out in accordance with the mining licence or resource consent conditions before the mining operation is closed down. If the rehabilitation carried out by the consent holder is not to the satisfaction of the consent authority, the Resource Management Act (s 109) enables the consent authority to carry out the necessary works and recover the costs from the bond. If the costs of the work exceed the amount recoverable from the bond, the excess amount becomes a debt due to the consent authority by the consent holder and, consequently, a charge on the land.

Even if rehabilitation is carried out either by the consent holder or the consent authority, there is at present no provision requiring consent holders to establish funds for any long-term care and maintenance of tailings dams after mine closure. Any subsequent remedial works and any unforeseen events giving rise to adverse environmental effects in the post-closure period become the responsibility of the land-owner/occupier. If the site is abandoned and there is no land-owner or occupier, this responsibility may fall, by default, on the Crown. The same principles which apply to orphaned contaminated sites would apply to abandoned land on which tailings have been deposited. Under these circumstances the Crown would need to assess the long-term risks to the environment and establish a monitoring and maintenance programme, and provide the necessary funding appropriate to the risks to be managed.

Provisions exist in the Resource Management Act (s 108), for local authorities to require financial contributions, although it is unclear

whether this provision would enable a local authority to require a financial contribution to fund the long-term management of tailings dams. The system of fees charged by local authorities under s 36(1)(c) of the RMA for the administration, monitoring and supervision of resource consents, and for carrying out resource management functions under s 35, may also provide a mechanism for funding long-term post-closure monitoring of high risk sites. This assumes that, in the post-closure period, some type of resource consent(s) is still required and that a consent holder exists who is responsible for paying the local authority's charges.

### **Options for disposing of and treating tailings**

The appropriate method(s) for disposing of tailings will be site-specific and will vary in terms of cost, effectiveness, risk and feasibility. One suggestion is for regional councils to identify in their regional plans 'natural hazard zones' which, because of unstable land conditions for example, are considered unsuitable for locating tailings dams.

The use of waste for underground backfill, particularly dense tailings paste backfill, is being essayed at a few mines around the world. Tailings disposal in abandoned mine workings is currently being attempted at a few sites, but this option can accommodate only a limited quantity of tailings. A key consideration with any underground disposal option is the protection of groundwater from contamination by leachate.

Acid drainage can be a significant problem after rehabilitation of the mine site and tailings dam, depending on the nature of the rock and the method used for closing off the tailings dam. Effective control options include:

- providing underdrainage to channel acid drainage from the tailings impoundment;
- collecting runoff from other sources of acid drainage such as waste rock stacks;
- providing water treatment facilities for treating all sources of acid drainage on site;
- using tailings cover systems (shallow or deep), such as soil or depyritised tailings, to avoid further oxidation of sulphide-bearing material and on which to grow vegetation;
- flooding the tailings (wetland or pond) to prevent oxidation;
- adding limestone to the tailings at the processing plant to neutralise acidity prior to disposal; and
- removing the tailings to another location, such as to the open pit or to underground workings.

A Canadian study (Knapp, 1991) using a model developed to analyse the effects of oxidation processes in mine tailings, and validated against

### **6.1.2 Managing the risks**

field data, indicates the predicted effects of five close-out options on the total quantity of acidity produced at a representative tailings site. The options ranged from:

*Option 1* The tailings basin is closed out with no remedial work except for the grading, shaping and vegetation of the tailings surface. The water table is assumed to be more than 4.5 m below the tailings surface.

*Option 2* The perimeter dams are replaced with new structures which cut off seepage to the ground. This option causes the water table to rise to within three metres of the tailings surface.

*Option 3* The perimeter dams are replaced with new structures which include complete cutoff of seepage to bedrock. This option causes the water table to rise within 1.5 m of the tailings surface.

*Option 4* A three metre cap of depyritised tailings is applied to the entire tailings surface but the existing perimeter dams are left intact. The water table remains essentially at the same level as the base case (Option 1).

*Option 5* A three metre cap of depyritised tailings is applied to the entire tailings surface and the perimeter dams are replaced with new structures which include complete cut-off of seepage to bedrock. This option results in the water table rising into the cover material, flooding the pyritic tailings.

As shown in figure 2, with options 1 to 4 total acidity continues to increase but more slowly over time. With option 5, the effect of raising the water table into the cover material is to essentially eliminate acid generation throughout the foreseeable life of the tailings. The results demonstrate that covering the tailings will substantially reduce the rate of acid generation, but will not necessarily affect the total quantity of acid generated unless the cover applied results in a rise in the water table within the tailings basin.

This example supports the idea that close-out options for a particular site should, prior to closure, be thoroughly assessed for their long-term environmental effects.

FIGURE 2

Source: Knapp (1991)

Submerging acid-generating waste is one of the best methods of inhibiting acid production during the operational and long-term phases, but it may increase the risk of a dam breach and also increase the volume of tailings released if a breach occurs. Where tailings are to be flooded, it may be necessary to divert runoff into the tailings pond to prevent exposure of tailings in dry periods. For long-term management, the trend is to minimise the quantity of contaminated water that has to be managed, treated and discharged into the environment. The less water there is to manage, the less long-term care and maintenance of a water treatment plant and equipment will be required.

Tailings impoundments which initially contain acid-producing materials and traces of process chemicals may, in the long term if properly capped, rehabilitated and managed, revert to a sustainable land use such as pasture. The slopes of the tailings dam at Martha Hill mine are already being used for this purpose. More recently, wetlands constructed to treat drainage from base metal mines or gold mill effluents have been considered viable long-term solutions for acid drainage and metal contamination (as distinct from being a treatment option during the operation phase). Sobolewski (1996) gives examples and references on the use of wetlands for cleaning up mine water contaminated with acid mine drainage. The process involves chemical reactions (hydrolysis) and biologically-driven reactions (formation of insoluble sulphides and carbonates) primarily for the removal of metals and their retention in sediments. Neutralisation of acidic water within wetlands occurs as a result of biological production of bicarbonate.

To compensate for the difficulty in accurately predicting performance of tailings impoundments, safety measures and back-up strategies need to be provided to handle adverse, unforeseen conditions. These matters need to be addressed by the licence holder in the site's emergency action plan and revised before the mine is closed to ensure that post-closure procedures and responsibilities are clearly set out in such a plan.

### **Costs of managing risks**

When considering an appropriate objective for managing the long-term risks to the environment from existing tailings dams, matters which are likely to affect ongoing costs include:

- how the tailings are being disposed of, and whether it is within a stable land mass and without degradation of the surrounding environment by emissions from the tailings;
- whether there are structures, contaminated lands or artificial land forms left on site that:
  - can endanger life, property or the environment;
  - are unstable, particularly with respect to erosion;
  - will contaminate surface runoff or groundwater to a harmful extent;

- whether the final structure can be rehabilitated to a landform and land use that is compatible with the surrounding environment; and
- whether there should be compensation for, or financial contributions to offset, costs or impacts that cannot be mitigated.

(Queensland Department of Minerals and Energy, 1993; Cragg et al, 1995).

The quality of construction, treatment and rehabilitation of tailings dams will be the critical factors that influence the costs of post-closure management. The more effort put into ensuring the long-term structural integrity of the dam and reducing the potential for acid drainage to occur, the fewer resources will be needed to carry out repairs and monitor environmental effects. In one case where rehabilitation was not carried out (see Appendix 1), contamination of water, as a result of acid and metal contaminated runoff from tailings, forced the local authority to install an alternative water supply for the town affected by the contamination.

Some mining companies adopt progressive rehabilitation (or ‘clean-as-you-go’) techniques. These reduce the costs of final rehabilitation and minimise the potential for future damage. They also provide opportunities to demonstrate the effectiveness of the proposed closure strategy. Mining activity and progress with rehabilitation constantly change the total estimated rehabilitation liability (ie, including any additional cost to public authorities should the mining company default) over the life of a mine.

### **Post-closure monitoring**

Post-closure monitoring programmes will be site-specific depending on the residual risks after rehabilitation. Monitoring programmes determined by the consent authority (regional council) may cover:

- water quality in the tailings pond;
- discharges from the water treatment plant;
- groundwater and surface water quality (on and off the site);
- moisture content in the tailings disposal area;
- seepages from the tailings and waste rock disposal areas;
- stability and integrity of the dam structure;
- consolidation of the tailings; and
- success of rehabilitation works (eg, to prevent acid mine drainage).

The development of monitoring programmes also requires response plans that would enable remedial actions to be put into effect if unacceptable discharges or structural problems occur. For example, low levels of contaminants may trigger only closer monitoring or study to ascertain the cause. Higher levels may activate plans to alter the treatment of tailings (eg, to prevent oxidation), while very high levels may require urgent remedial action. Sample frequency and level of

analyses could be established in a monitoring programme and the appropriate response plan triggered when predetermined criteria are exceeded.

### **Managing long-term risks by consents or plans**

Methods for managing long-term environmental and safety risks include:

- attaching conditions to resource consents for individual activities on the mine site;
- a resource consent (eg, water discharge permit) that sets conditions on total discharges leaving the entire site;
- blanket controls in regional or district plans (eg, restrictions on future land use of tailings dams sites) for all sites; and
- building consents and any requirement for an annual building warrant of fitness for the dam structure.

An advantage of having consents for each site on which a tailings disposal facility is located is that the consent conditions would be site-specific, addressing actual or potential risks which are likely to vary over time. An assessment of environmental effects would need to be carried out each time a resource consent had to be renewed by the landowner or occupier until, at some time in the future, monitoring indicated that no further harmful discharges were occurring.

Blanket controls (rules) in regional or district plans may be useful for setting out restrictions, obligations and responsibilities in relation to tailings dams as contaminated sites, for example, to provide a general guide on how long-term environmental risks are to be managed.

A requirement for an annual warrant of fitness for the dam structure will largely depend on the outcome of proposals on dam safety legislation currently being prepared by an officials committee chaired by the Ministry of Commerce. Future dam safety controls are likely to be based on the hazard potential of the dam.

In line with the ‘polluter pays’ principle, it would be appropriate for the mining licence holder to contribute towards monitoring and maintenance costs in the post-closure phase. Ongoing costs include monitoring environmental effects; maintaining treatment plants, drainage systems and other essential equipment; and carrying out any necessary repairs and remedial work. As previously mentioned, such costs will depend mainly on the effectiveness of rehabilitation and on the nature, extent and duration of any environmental risks remaining after the mine closes.

## **6.2 Funding options for post-closure management**

Funding options which reduce the likelihood of public funds being required for post-closure management of tailings dams include:

- retaining part of the bond or monetary deposit;
- establishing a specific trust fund;
- taking out environmental insurance; or
- using a combination of these options.

**6.2.1 Bonds** Bonds or monetary deposits are generally designed to provide security against non-compliance with rehabilitation requirements only. In New Zealand's mining legislation, bonds have not been regarded as a funding mechanism for post-closure care, although bonds linked to conditions on some water rights cover the post-closure period. Once rehabilitation is completed and satisfies the requirements of the licence, the bond is cancelled or the monetary deposit returned to the licence holder. There is only provision to withhold a bond, or part of it, until the required rehabilitation is completed. The bond, or part of it, is forfeited if the licence holder fails to comply with the rehabilitation requirements.

Bonds need to be sufficient to ensure that the planned rehabilitation of the tailings disposal area is completed even if the project is closed early or abandoned. In an earlier report, the cost of rehabilitation of a mine site was estimated to represent approximately one percent of the capital cost of a project (PCE, 1988). When estimating the bond value it is important to base it on future rehabilitation expenditure, and to assume that if the licence holder fails to rehabilitate the site, the work would be carried out by contractors on behalf of the public authority holding the bond.

A Canadian report on mine reclamation security policy (British Columbia Advisory Council on Mining, 1996) recommended that cost estimates (for rehabilitation) should be based on the level of assessed risk posed by individual companies. The report recommended the use of industry estimates for mining companies classified as low risk, and the use of consent authority figures in cases where a high risk of default is indicated. The report separately addressed the estimation of long-term acid drainage costs, where reclamation may be required long into the future. Based on the experience gained at one particular mine, the report recommended that a specific process of negotiation be employed by the consent authority, the individual company and public stakeholders in determining the total reclamation liability for acid drainage mines. The report also reviewed various methods of setting a discount rate for funding of long-term reclamation, recommending that this be done on a mine-by-mine basis.

Legislation in the United States of America (United States Code, Title 30, 1994) requires that, where a silt dam is to be retained as a permanent impoundment, parts of the bond may be released as long as

provisions have been made for sound future maintenance by the operator or the land-owner.

Under the Resource Management Act 1991 (s 108(1)(b) and (6)(c)) a resource consent may include a condition requiring that a bond be given in respect of the performance of any one or more conditions of the consent. The consent holder is not only liable for any breach of conditions before the expiry of the consent, but may also be liable for any adverse effects on the environment after the consent expires. In other words, in relation to tailings dams the consent holder may remain liable for any adverse effects occurring after mining has ceased. It is unclear, however, how s 108(6)(c) may be implemented.

In the case of landfill sites, one regional council (Auckland Regional Council in respect of Whitford Landfill) has stipulated post-closure care periods of 30 years in discharge permit conditions. Conditions of the permit specify, among other things:

- frequency of monitoring;
- review of monitoring requirements;
- a contingency sum (annually adjusted and reviewed) to provide for early closure, environmental remediation and post-closure care, and to ensure compliance with consent conditions; and
- in the event of the consent being transferred to another party, a bond (annually adjusted) payable by the new holder of the consent to provide security for early closure, and reviewed annually to ensure that the bond is appropriate to the level of risk.

(L. Wesley, pers comm)

One option which would cover not only the costs of rehabilitation but also long-term care, maintenance and monitoring of tailings dams is the concept of a “trustee environmental fund” (TEF) (Waters, 1993, p 405). The concept promoted by Waters is the establishment of a fund that replaces a one-off lump sum bond or deposit but which still provides an assurance that rehabilitation will be adequately financed.

### **6.2.2 Trust fund**

Another option is to establish a trust fund, separate from any rehabilitation performance bond, deposit or other instrument, for the specific purpose of covering the costs of post-closure management of environmental effects and the clean-up of any off-site effects. The merits of establishing a mining industry-wide trust fund to cover post-closure management of all tailings dams, including the clean-up of old sites, could also be explored.

During the operation phase of the mine, the licence or permit holder could make periodic payments or pay a lump sum to the trust fund. The trust deed would provide for the appointment of trustees, investment of trust funds, and purposes for which funds would be used. The idea of

shared trusteeship between the consent holder, the consent authority and other affected parties would create an affiliation in which the parties could work together towards an agreed outcome. Such a trust fund would be the primary source of funding for post-closure management of environmental effects. It would be protected against any claims by creditors of the mining company. One drawback may be the fund's inadequacy to meet all post-closure costs if the company goes into liquidation or abandons the site in the early years of operation. If the investment period is less than about ten years a trust fund, which essentially is to be built up by investment return, has too little time in which to grow. To overcome this, a suitable lump sum could be invested at an early stage.

Advantages of a trust fund for long-term management purposes include:

- the licence/consent holder can choose to contribute to the trust fund during the mine's operation phase, or provide a lump sum at the time of closure (when the long-term management commitment may be easier to assess);
- funds can be invested and grow to meet future needs;
- the fund can be managed by the licence/consent holder until the expiry of the licence/consent and then handed over to the local authority or a separate board of trustees to administer; and
- the funds can be targeted to deal specifically with post-closure, long-term monitoring and maintenance.

In the United States, legislation requiring owners or occupiers of hazardous waste facilities to establish financial assurance for post-closure care (United States Code, Title 40, 1995) enables a range of mechanisms to be used, including post-closure trust funds. Payments into a fund must be made annually by the owner or operator over the term of the initial permit or over the remaining operating life of the facility as estimated in the closure plan, whichever period is shorter (the 'pay-in period'). The owner or operator may accelerate payments into the trust fund or may deposit the full amount of the current post-closure cost estimate at the time the fund is established, provided that the value of the fund is maintained at the required amount. Surplus funds may be released if the value of the trust fund exceeds the remaining cost of post-closure care.

Public authorities involved in the management of environmental effects have an interest in ensuring that long-term liabilities associated with tailings dams are properly valued and funded, to avoid any risk of public funds being called upon to remediate problem sites – sites that have been abandoned, have not been satisfactorily rehabilitated due, for example, to cost overruns, or are affected by unforeseen circumstances.

Public liability insurance is one option by which companies and local government can make financial provision for any future remediation or clean-up of a site. Environmental insurance is a relatively recent

### **6.2.3 Environmental insurance**

product and was first designed in the United States as a complementary product to cover environmental risks not covered by traditional comprehensive general liability policies. The market for such products has fluctuated as judicial decisions in the United States held that general liability policies covered environmental claims. In the 1980s, environmental risks were being better evaluated and insurance companies modified their general liability policies to exclude pollution events. In some cases, pollution coverage is restricted to 'sudden and accidental' events. However, courts in the United States are finding that 'sudden' is ambiguous in meaning where pollution events are involved.

Before an insurance company could craft a policy for a company or a public authority, a thorough understanding of risk exposures would be required. The cost of such policies, in relation to the cover offered, may make them an unrealistic option for either consent holder or consent authority. Coverage for damage caused by gradual pollution, such as leachate, is not available and, in some instances, the cost of site clean-up is not covered. Insurance cover may be available against the risk of rising environmental remediation costs.

Post-closure insurance is an approved mechanism under the United States Code, Title 40, 1995. In this legislation a post-closure insurance policy must be issued for a face amount at least equal to the current post-closure cost estimate. It must guarantee that funds will be available to provide post-closure care of the facility whenever the post-closure period begins, and that the insurer will be responsible for paying out funds to specified parties up to an amount equal to the face amount of the policy. Each policy must contain a provision allowing the policy to be assigned to a successor owner or operator, although this may be conditional upon the consent of the insurer. The policy must provide that the insurer may not cancel, terminate, or fail to renew the policy unless the policy holder has failed to pay the premium. However, because this places the onus on the policy holder to maintain payments of the premium, it does not provide guaranteed funding for post-closure care.

Other options provided for in United States legislation on hazardous waste facilities (Title 40,1995) include:

#### **6.2.4 Other financial assurance options**

### **Surety bond guaranteeing payment into a post-closure fund**

The owner or operator who uses a surety bond must also establish a standby trust fund. The surety becomes liable when the owner or operator fails to perform as guaranteed by the bond.

### **Surety bond guaranteeing performance of post-closure care**

The terms and conditions of this are similar to the previous option.

### **Post-closure letter of credit**

Under this option the owner or operator is required to obtain a letter of credit which conforms to certain requirements. A standby trust fund is also required. The letter of credit must be irrevocable, issued for a period of at least one year and automatically extended for further periods of at least 1 year each. It must be issued in an amount at least equal to the current post-closure cost estimate and can be adjusted if the cost increases or decreases.

### **Financial test and corporate guarantee for post-closure care**

To satisfy this requirement the owner or operator must have all of the following:

- two of the following three ratios: a ratio of total liabilities to net worth less than 2.0; a ratio of the sum of net income plus depreciation, depletion, and amortisation to total liabilities greater than 0.1; and a ratio of current assets to current liabilities greater than 1.5;
- net working capital and tangible net worth each at least six times the sum of the current closure and post-closure cost estimates and the current abandonment cost estimates;
- tangible net worth of at least US\$10 million; and
- assets in the country amounting to at least 90 percent of total assets or at least six times the sum of the current closure and post-closure cost estimates and the current abandonment cost estimates.

An owner or operator may also meet the requirements by obtaining a written guarantee from their higher-tier parent company or a firm with a substantial business relationship with the owner or operator.

### **Use of multiple financial mechanisms**

The United States legislation allows more than one financial mechanism to be used per facility. These mechanisms are limited to trust funds, surety bonds guaranteeing payment into a trust fund, letters of credit and insurance mentioned above.

The British Columbia Advisory Council on Mining (1996) recommended that a broad range of security instruments should be available and acceptable to increase the likelihood that full security will be in place throughout the operational life of a mine. As rehabilitation requirements increase towards the end of a mine's life (see figure 1), the British Columbia report recommended that 100 percent 'hard security' (ie, convertible to cash, readily available and in the full amount needed) be required at or before closure for all single mine companies and for mines with acid mine drainage.

The extent to which a tailings dam site will require post-closure care and maintenance depends on:

### **6.3 Summary**

- the nature of the tailings;
- the efforts by the mining licence holder to design, construct, operate and rehabilitate the site to avoid adverse effects on the environment; and
- whether events occur either during or after mine closure which were not foreseen and which affect the environmental and safety risks posed by the tailings dam.

A well-managed and rehabilitated site will reduce the potential for adverse effects to occur after closure. In natural hazard-prone areas or under other exceptional circumstances, however, such sites may create risks that are costly to remedy.

Transitional legislative provisions applying to current mining licence holders require them to rehabilitate the site, and to provide security that this will be done, but not to fund any post-closure management of effects on the environment. There are provisions in the RMA which enable councils to require financial contributions from resource consent holders (see chapter 2.3.2) to offset any adverse effects of future mining projects.

Other jurisdictions examined during the course of this investigation have established systems in which an operator contributes towards long-term monitoring and maintenance of high-risk activities. This is consistent with the 'polluter pays' principle. A funding system based on the level of residual risk at the time of closure of a tailings dam site would provide a fair means of ensuring that the management of such risk is adequately funded. Any funding system should be flexible and provide the operator with a range of options that meet both resource needs and environmental outcomes.



## 7 FINDINGS

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The following summarises the findings of this investigation from which recommendations are made in relation to the long-term management of the environmental effects of tailings dams. A distinction is made between issues related to existing mining licences, and those related to any future mining proposals involving the impoundment of tailings.

Mining activities involving the use of facilities for the long-term storage of tailings generate a number of short- and long-term benefits, risks and costs.

The benefits of mining to affected parties in New Zealand are short term relative to the potential environmental risks and costs, and to the length of time tailings dams will exist. Benefits include profits to the mining company, revenue to the Crown associated with the allocation of the resource (eg, royalties where applicable) and taxes, and employment and economic growth opportunities for the local community.

### **7.1 The benefits, risks and costs of mining and associated tailings dams**

#### **7.1.1 The benefits**

The long-term risks to the environment from tailings dams include the potential for dam failure and contamination of land and water by acid leachate. The risks will be site-specific and will depend on the design, construction and maintenance of the dam structure, the stability of the land on which the dam is located, the nature of the material impounded, the method and effectiveness of site rehabilitation, and other contributing factors such as natural hazards.

#### **7.1.2 The risks**

There may also be risks to the values and traditional relationships of tangata whenua with their ancestral lands, water and waterways and other taonga (valued resources). The potential impacts for Maori can include spiritual and intangible dimensions as well as the physical environment, within the overarching framework of kaitiakitanga (traditional guardianship).

The Crown faces the risk of ultimately being responsible for the clean-up and management of a tailings dam site that is abandoned (becomes an 'orphan' site).

#### **7.1.3 The costs**

There are long-term costs to communities, and future

generations, which inherit any adverse effects from tailings storage facilities. In some instances, tailings dams may be classified as contaminated sites, thus placing restrictions on the future use of the land and, consequently, an opportunity cost on both the local authority and the land-owner.

There are short- and long-term costs to regional councils who have environmental monitoring responsibilities under the transitional provisions of the Crown Minerals Act and under the Resource Management Act. The Crown Minerals Act devolves compliance monitoring and enforcement responsibilities, relating to environmental conditions of mining licences, to regional councils.

Regional councils are able to recover only those costs associated with administering the Resource Management Act.

## 7.2 The ‘polluter pays’ principle

The ‘polluter pays’ principle is applied, by way of bonds, monetary deposits and licence conditions, to ensure that either the licence holder carries out the necessary rehabilitation of the site or that, by default, rehabilitation is carried out by another party when mining ceases or if the site is abandoned.

Mining licence holder ‘polluter pays’ obligations end when the mine site is rehabilitated, in accordance with the mining licence conditions, in preparation for closing the site.<sup>69</sup>

Bonds or deposits need to be sufficient to ensure completion of the rehabilitation requirements of the licence, permit or consent. For this reason it is important that they are regularly reviewed, particularly where risks to the environment and costs of rehabilitation increase due to unforeseen circumstances.

Mining licence bond or monetary deposit arrangements to cover rehabilitation of tailings dams are currently not available for the post-closure management of environmental effects.

Any ongoing **maintenance** costs will depend on how well the site has been rehabilitated and are borne by the owner of the land, who may not necessarily be the mining company. In the case of an ‘orphan’ site (one which has been abandoned by the owner) there is a risk that the liability will ultimately rest with the Crown. After the mining licence expires (or is surrendered) and the site is rehabilitated, any continuing environmental **monitoring** costs are currently borne by the local authority.

<sup>69</sup> This does not mean, however, that the licence holder is no longer liable for any adverse environmental effects. There could be civil liability for undiscovered effects which cause damage and the licence holder/site owner, if still around, could be sued by an affected party.

As outlined in chapter 2, existing mines that were licensed under the former Mining Act 1971, and are now governed by the transitional provisions of the Crown Minerals Act 1991, continue to operate under the conditions of their mining licences and the requirements of the Mining Act until the licences expire. The licences of the three mines in this category, which operate tailings dams, expire between the years 2010 and 2020, although one of them is likely to close within the next year.

### **7.3 The transitional regime and existing tailings dams**

A significant deficiency in the old Mining Act and in the transitional arrangements of the Crown Minerals Act, is the absence of any provision requiring the licence holder to carry out or fund any post-closure monitoring and maintenance of tailings storage facilities that have the potential to adversely affect the environment for many years after closure.

There are a range of options for funding the post-closure management of tailings dams that could be provided for by legislation. The option of a trust fund, for example, has a number of benefits for the licence holder, the consent authority and the local community.

### **7.4 The new regime and future tailings dams**

#### **7.4.1 Regional and district plans, and resource consents**

Future mining operations will come under the Crown Minerals Act/Resource Management Act regime, under which the management of environmental effects of mining activities could be addressed in regional and district plans and/or the resource consent process.

General parameters governing activities that are likely to have an effect on the environment can be established in regional and district plans. Rules in plans may prohibit, regulate or allow future mining operations having regard to their actual or potential effect on the environment. For example, sites prone to natural hazards may be declared unsuitable for locating tailings dams. Plans may also contain provisions requiring consent applicants to make a financial contribution to offset any adverse effects (see chapter 2.3.2). However, it is unclear whether a financial contribution can be required to fund long-term monitoring and maintenance of tailings dams.

It is likely that resource consents may be required to manage site-specific risks (eg, the acid-producing potential of the rock and tailings), and to ensure that site owners or occupiers fulfil their responsibilities for avoiding, remedying or mitigating any long-term adverse effects and meeting any bond conditions in a resource consent.

Under the Resource Management Act 1991 (s 108(1)(b) and (6)(c)) a resource consent may include a condition requiring that a bond be given in respect of the performance of one or more conditions of the consent. The bond may explicitly provide that the consent holder is not only liable for any breach of conditions before the expiry of the consent, but also for any adverse effects on the environment after the expiry of the consent. In other words, in relation to tailings dams the consent holder may remain liable for any adverse effects occurring in the post-closure period, although it is likely that a specific rather than an indefinite period would apply to the bond.

As part of their function to administer resource consents, local authorities may impose a charge on the consent holder for monitoring compliance with consent conditions. This may include conditions relating to the control of long-term effects.

Risks to the environment and downstream communities will vary over time. Post-closure monitoring may be necessary until the landowner/occupier can demonstrate that the site is safe, stable and meeting selected environmental performance criteria.

**7.4.2 Dam safety** The proposals for dam safety legislation being developed by an inter-departmental committee chaired by the Ministry of Commerce, require some clarification on the method of classifying hazards, and how the proposed amendments to the Building Act will apply to long-term risks posed by existing tailings dams.

**7.4.3 Contaminated sites** Tailings dams are likely to fall within the definition of ‘contaminated sites’ in the current proposal for legislation dealing with liabilities in relation to such sites. It is important that these proposals also clarify responsibilities for continued monitoring and maintenance of sites which have the potential to adversely affect the environment in perpetuity.

The risks posed by existing and future tailings dams need to be assessed on a case-by-case basis. Local and community knowledge about natural hazards in the vicinity of an existing or proposed tailings dam needs to be acknowledged along with any technical information on the potential risks. Establishing a risk assessment methodology would enable permit/consent applicants and consent authorities to apply a consistent approach to assessing new mining applications, as well as identifying post-closure risks from existing tailings dams.

## 7.5 Methods for assessing and managing long-term risks

A generic code of practice for managing tailings dams in order to prevent or reduce risks of structural failure or environmental contamination would provide guidance for licence/permit/consent holders and consent authorities on pre- and post-closure management of tailings dams. Such a code could be developed by the mining industry in consultation with consent authorities and relevant central government departments. There are many examples of where industry has taken such initiatives, and this should be encouraged. Input from public authorities and other interested parties would help ensure that a code of practice adopts appropriate standards.

Table 1 summarises the liabilities, management and funding responsibilities for existing tailings dams.

## 7.6 Summary

Generally, options for disposing of tailings are limited. This invariably results in the need to construct a purpose-built structure to impound the tailings in perpetuity.

Existing mining licence holders and their successors to the land on which tailings are stored are responsible for ensuring the safety of the dam and for avoiding, remedying or mitigating any adverse effects on the environment.

In relation to future mining proposals, opportunities exist under the new regime for local authorities to set rules in their regional or district plans and/or conditions in resource consents to address many of the issues raised in this report about managing long-term effects on the environment. For example:

- rules can, where appropriate, prohibit certain mining activities on the basis of their actual or potential effects on the environment;
- plans can provide for financial contributions to be made by resource users to offset any adverse effects of their activities, although it is unclear whether this would apply to funding the long-term monitoring and maintenance of tailings dams; and
- resource consent conditions may require a bond, or a covenant to be entered into, to provide an assurance that rehabilitation and post-closure monitoring and maintenance will be undertaken.

With the exception of the Tui mine, none of the existing mine sites with tailings dams have reached the closure stage, although one is likely to close within a year. The timeframe in which to establish financial assurance mechanisms for the long-term management of existing tailings dams is in some cases too short to build up the necessary funds. However, the costs may be reduced if ongoing and final rehabilitation is effective, and the acid-producing potential of the tailings and waste rock is low.

The risks to public authorities and the environment are where bonds have not been required, where unforeseen events arise during the operation phase which increase the cost of rehabilitation beyond the amount in the bond, or where the licence holder abandons the site and the rehabilitation costs exceed the amount in the bond. The management of such risks and the potential impact on public funds are issues that both central government and local authorities need to address.

**Table 1: Long-term, Post-closure Management of Environmental Effects of Existing Tailings Dams  
Summary of liabilities, management and funding responsibilities under the current regime**

	<b>The Crown (Minister of Energy)</b>	<b>Regional Councils</b>	<b>Territorial Authorities</b>	<b>Mining Companies</b>	<b>Land-owners<sup>70</sup></b>
<b>Liabilities and Responsibilities</b>	Minister approved environmental conditions in pre-1991 mining licences, but now not responsible for the enforcement of them (responsibilities ceased on 1/10/91)	Monitor compliance with regional plan and with mining licence and resource consent conditions relating to environmental effects	Monitor compliance with district plan and with conditions of land use and building consents; also monitor noise, vibration, dust, roading and hours of operation	Liabile for rehabilitation of mine sites and complying with other licence and consent requirements	Duty to avoid, remedy or mitigate any adverse effects on the environment in the post-closure phase; if site is abandoned, the Crown may become responsible
<b>Management of Environmental Effects</b>	Not applicable	Via regional policy statements, regional plans resource consents, mining licences and monitoring strategies	Via district plans, resource consents and building consents, and monitoring strategies	By complying with statutory plans and consents, and any environmental management systems and strategies developed by the company to manage environmental effects	By complying with statutory plans and consents, and by avoiding, remedying or mitigating any adverse effects on the environment
<b>Funding</b>	Has first call on 50% of mining licence bond or deposit to ensure compliance with conditions (other than environmental conditions), and payments of debt to the Crown	Share first call on remaining 50% of mining licence bond or deposit, and any remaining portion of bond not required by the Crown for payment of debts, to ensure rehabilitation is carried out satisfactorily if the company fails to do so; no specific funds available for post-closure monitoring	Share first call on remaining 50% of mining licence bond or deposit, and any remaining portion of bond not required by the Crown for payment of debts, to ensure rehabilitation is carried out satisfactorily if the company fails to do so; no specific funds available for post-closure monitoring	Provide bond or deposit to ensure rehabilitation is carried out satisfactorily if company fails to do so; mining licence does not require financial assurance for post-closure care to be provided	Must make own arrangements for funding post-closure management of site

<sup>70</sup> In some cases, the mine site may change ownership after the mine closes. If the mining company continues to be the land-owner, both comments would apply.

## 8 RECOMMENDATIONS

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### To the Minister for the Environment:

1 That the Minister, in consultation with the Minister of Energy, introduces legislative changes that enable local authorities to apply appropriate funding mechanisms (such as trust funds or bonds) requiring mining licence holders, where necessary, to meet the costs of post-closure, long-term management of the environmental effects of **existing** tailings dams.

2 That the Minister introduces an amendment to the Resource Management Act that enables local authorities to impose a consent condition requiring an applicant for any **future** mining proposal to establish a trust fund for the purpose of funding the long-term management of a tailings dam, and that such a trust fund would be administered by the consent authority after the mine closes.

3 That the Minister, in consultation with the Minister of Energy and local government, develops a methodology for assessing long-term, post-closure risks to the environment associated with tailings dams.

4 That the Minister, in consultation with the Minister of Energy, the Minister of Lands and the Minister of Finance, assesses the risk to the Crown of tailings dam sites being abandoned, and determines whether additional risk management measures are necessary to protect the Crown from liability for future clean up costs.

5 That, in the proposed legislative changes relating to contaminated sites, the Minister includes provisions that allocate responsibility for continued monitoring and maintenance to ensure that either the sites have been cleaned up to a required standard or that the contamination is, and remains, securely contained.

6 That the Minister provides guidance to local authorities on the implementation of s 108(6)(c) of the Resource Management Act, relating to the liability of a consent holder for any adverse effects on the environment after the expiry of the consent, including clarification of the duration of the term of any bond.

### **To the Minister of Internal Affairs**

7 That the Minister, in consultation with the Minister of Commerce, addresses the following matters relating to dam safety in the proposed amendments to the Building Act 1991:

- a) introducing a hazard classification for tailings dams that includes consideration of the potential harm to the natural environment, especially water bodies;
- b) including controls that reflect not only the potential effects of catastrophic dam failure, but also long-term contamination due to seepage and escape of acidic tailings;
- c) clarifying that the owner of a tailings dam is responsible for the safety, monitoring and maintenance of the dam structure;
- d) clarifying that the legislation will apply to dams in existence at the time the legislation is passed.

### **To local government:**

8 That regional councils and territorial authorities, when considering consent applications for future tailings dams, ensure that:

- a) any accompanying assessment of effects on the environment (AEE) addresses risks to the environment (short- and long-term, before and after closure) and how they are to be managed; and
- b) local and community knowledge of natural hazards and instability of the area in which tailings dams are to be located are properly considered, along with any technical information.

9 That councils, in developing regional or district plans, where relevant:

- a) identify prospective mining areas which, by virtue of their instability, being prone to natural hazards or otherwise require to be protected from adverse effects, are considered unsuitable for locating tailings dams and, in such circumstances, should be regarded as prohibited activities;
- b) identify areas where acid mine drainage is likely to occur and the controls necessary on activities and structures to avoid long-term adverse effects on the environment due to acid mine drainage and other contaminants;
- c) identify the objectives of site rehabilitation (eg, either a 'walkaway' or 'passive care' solution – see chapter 4.3);
- d) include environmental performance standards for discharges from tailings dams;
- e) identify restrictions on future land use of tailings dam sites; and

f) identify how rehabilitation and long-term management costs of future mining projects are to be estimated to ensure that adequate funding is available if the permit holder defaults.

10 That regional councils regularly review bonds or monetary deposits to assess whether they are adequate to meet the costs of rehabilitation if the licence or permit holder fails to do so.

11 That regional councils and territorial authorities assess the financial risks to themselves of having to carry out long-term monitoring of tailings dam sites.

12 That regional councils require mining licence holders to submit a residual risk assessment (based on the methodology referred to in recommendation 3) with their closure plans to identify how long-term risks from tailings dams are to be managed.

13 That local authorities enter into negotiations with existing mining licence holders to ensure that an adequate funding arrangement is put in place for the long-term monitoring and maintenance of existing tailings dams, for example, by providing for a covenant over the affected land which will bind future owners of the land.

### **To the mining industry:**

14 That, where practicable, mining companies progressively rehabilitate their mine sites during the operation phase to minimise the cost of rehabilitation at mine closure and the potential for future environmental damage.

15 That the mining industry, in consultation with the Ministry of Commerce, the Ministry for the Environment and local government, develops a code of practice for the long-term management of tailings dams.



# Appendix 1

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## **TUI MINE – A CASE STUDY**

The following is a summary of the long-term management issues that arose as a result of the closure of the Tui mine site in 1973. Information is principally drawn from four sources (Singh-Thandi, 1993; Morrell, 1995; Hart, 1996 and D Carter, pers comm).

### **Background**

Between 1965 and 1974 the Tui mine was operated by Norpac Mining Limited. In 1966 Norpac was granted a licence, under the Mining Act 1926, to establish a mine and mill site at the Tui mine on Crown land. Under the 1926 Act there was no provision requiring the posting of a bond to cover the cost of rehabilitation of the site. Additional land was obtained for the tailings dam from the Te Aroha Borough Council (TABC) in an agreement entered into by the Minister of Mines and the Mayor of TABC at that time. Several special site licences were granted by the Mines Department and included some conditions put forward by the Hauraki Catchment Board (HCB) which had responsibilities under the Water and Soil Conservation Act 1967.

In February 1974 Norpac went into receivership and liquidation of the company finally took place in January 1976.

Tasman Gold, a wholly-owned subsidiary of Mineral Resources, has the right to mine the area under mining licences acquired from the receiver of Norpac in 1974 and transferred to Tasman Gold in 1980. Tasman reapplied for a prospecting licence for Tui mine in 1989, but in a subsequent Planning Tribunal hearing in 1991, the Tribunal decided not to permit any prospecting on the grounds that past evidence indicated that environmental problems in the area were not yet resolved.

### **Post-closure risks**

Tailings ceased to be deposited in 1973. An independent consultant's report in the late 1970s revealed that although the tailings dam site was generally stable as long as water could be kept off the tailings surface, measures including rehabilitation and ongoing monitoring and maintenance of the dam needed to be undertaken. Problems began to occur as a result of acid mine drainage emanating from mine adits and the abandoned tailings dam. For more than twenty years the release of acid mine drainage and heavy metals has caused severe contamination of two local streams, both of which were sources of the town's water supply,. Since the mine ceased operation little effort has been made to reclaim the area. Shortly after the mine closed, lack of maintenance had

caused a minor dam breach during heavy rainfall and there were concerns about possible scouring and erosion of the dam.

The TABC considered that the only long-term solution was to relocate the tailings. However, the HCB was reluctant to see the pollution problem being shifted from one site to another and, on this basis, the Mines Department decided not to give their approval to remove the tailings. Concerns were expressed about the hazards of removing the tailings, the stability of the dam if the work was not properly supervised, and risks to the workers and equipment involved in any removal operation.

### **Responsibility and liability issues**

The regime at the time when Tui mine was operated by Norpac did not make it clear who was responsible to fund the remedial works; there were no provisions for a bond to be entered into, and inadequate provisions were made for the long-term monitoring and rehabilitation of the tailings dam site.

The TABC was critical of the Mines Department for allowing works to be carried out on the mine site and then, on completion of the works, handing the responsibility for rectifying any actual or potential environmental damage back to the original owner of the site (the TABC in this case of the tailings dam site). The council felt that the need for monitoring and maintenance was necessitated solely by the mining operations and that the funding for these should come from the mining sector as well as the Minister who granted the mining licence.

The continuing monitoring and maintenance of the tailings dam was regarded as a liability by all three public authorities involved (TABC, HCB and the Mines Department) and none was willing to accept that liability. Both the council and the Mines Department sought legal advice as to who was responsible for the tailings problem after the company went into liquidation. Both disclaimed any responsibility. The HCB was frequently called upon to carry out remedial work on the tailings dam site to deal with the instability of the tailings heap and water quality problems. This was becoming a drain on the board's resources and the HCB was unwilling to continue indefinitely diverting its funds to stabilise the tailings.

In 1980, in response to growing concern about the fate of the tailings in an area of such high rainfall, the HCB requested a contribution from the Minister of Energy towards the cost of damming and stabilising the tailings, and reducing the pollution caused by the tailings. The Minister of Energy advised that the Government had no legal liability to meet compensation claims. Nevertheless, in 1981 the Minister offered to meet half the \$50,000 cost of stabilising works on the basis that this was the limit of the Government's contribution toward the costs incurred with the tailings. The HCB constructed an embankment to

prevent any further movement of the tailings and to safeguard life and property downstream. The TABC was concerned that it inherited a problem that constituted a long-term expense and one that the council did not have the expertise to deal with.

In effect, no party wanted to initiate a long-term management programme in case it implied that they had accepted legal and financial responsibility.

Although Norpac did not set out to create a pollution problem, it found itself in financial difficulty and, after liquidation, was not in a position to do anything about it. The main issue after Norpac collapsed was to decide which agency was responsible for the tailings – a question that was never satisfactorily resolved.

### **Current situation**

The Matamata-Piako District Council, as owners of the land on which the tailings are located, are responsible for the clean-up of contamination from the site. The Council carries out only routine checks and maintenance of contour drains. Effluent from the underdrainage system continues to be discharged, untreated, into the two local streams. Since 1993, the Ministry of Commerce has been funding some maintenance work and six-monthly inspection reports prepared by an independent consulting firm. Copies of the reports are sent to the district and regional councils. Environment Waikato, as the regional council, has the responsibility under the RMA to monitor the environmental effects and the stability of the tailings dam.

In June 1995, Environment Waikato coordinated a meeting to discuss a number of concerns about Tui mine and its future. This involved representatives from the local authorities, the Ministry of Commerce, Department of Conservation, a local community group (Te Aroha Earthwatch) and representatives from the two mining companies in the Coromandel area. Representatives of the mining companies had observed that a clean-up at Tui was achievable and they were to look into the technical options (Environment Waikato memorandum, 60 11 04A of 28 June 1995). It was agreed to set up a technical liaison group and this was later endorsed by the Planning and Environment Committee of Environment Waikato. A second meeting in 1996 coincided with a visit to the site by an Australian mine specialist. Unfortunately this did not result in any practical solutions being identified for the site. No further progress has been made on the mitigation of environmental effects, including continued high levels of contamination of the Tui and Tunakohoia streams. Pollution of these streams has meant that the local authority has had to establish an alternative source of water supply for Te Aroha.

The future prospects for site rehabilitation and maintenance are unclear, due to lack of resources and commitment among the three public authorities involved.

### **Options for long-term management**

The Tui mine tailings are largely unoxidised at depth and, if disturbed and re-exposed, are likely to continue to produce acid mine drainage for many decades to come if steps are not taken to rehabilitate the site. Rainwater falling on the surface of the tailings and groundwater flowing through the heap allow oxidation to occur. Leachate draining from the heap mixes with and contaminates spring water in the base of the tailings.

Research undertaken at Massey University (Morrell, 1995) indicates that direct revegetation of the tailings area may provide a cost-effective means of reclaiming the site and mitigating acid mine drainage. This involves the application of lime and composted sewage sludge which raises and maintains the pH of the tailings sufficiently to support plant growth. Although revegetation would not entirely prevent acid drainage, it would stabilise the tailings and reduce erosion, and reduce the rate of oxidation of the sulphide minerals.

However, a previous trial in 1979 showed that direct treatment with lime and sludge may not be sustainable. The tailings may need to be capped, gravel placed over the cap and subsoil and soil placed on top to stop capillary movement of acid and minerals upwards which will affect the viability of the cover.

There will be a perpetual need for 'after care' of the site, and any rehabilitation will have to be managed to ensure that the objective of limiting water access to the tailings is maintained forever. Once rehabilitation has been carried out, it may be necessary to drain the system and treat any leachate before it is discharged (Environment Waikato memorandum, 60 11 04A, of 1 July 1995).

Removing the tailings has long been considered an option, but finding a suitable site for their disposal remains a problem. The estimated cost of removing the tailings in 1979 was \$200,000.

Any assessment of the total cost to public authorities of the Tui mine being abandoned would need to at least include the costs of:

- securing or relocating the tailings to avoid any further environmental damage;
- cleaning up the damage that has already occurred;
- supplying Te Aroha with an alternative source of water; and
- monitoring and maintaining the site.

### **Conclusion**

The Tui mine was granted a licence to operate under a regime which promoted mining but did not require any financial assurance from the licence holder to cover the costs of site rehabilitation in the event of failure to do so by the licence holder. This situation would not arise under the RMA/CMA regime, provided that any bond or monetary deposit was sufficient to cover the actual costs of rehabilitation.



## Glossary

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- Acid mine drainage:** The low pH, high heavy metal discharge typical of sulphidic mine wastes, and most commonly associated with the production of ferrous iron and sulphuric acid through the oxidation of iron pyrite. The terms ‘acid rock drainage’ or simply ‘acid drainage’ are also used to mean the same thing.
- Capping:** Various methods of covering the surface of tailings to prevent or reduce the potential for pyrite oxidation. Covers can range from a single gravel cover to a multi-layered cover including topsoil and vegetation.
- Close-out:** The time, after the mine has closed and rehabilitation has been completed, when the mining licence holder has satisfied all the restoration conditions of the mining licence.
- Decommissioning:** Activities, such as rehabilitation and restoration, to prepare the mine site for close-out.
- Depyritised tailings:** Tailings that have been processed to reduce the content of acid-producing minerals such as pyrite.
- Freeboard:** In relation to tailings dams, the vertical distance between the highest allowable static surface water level and the crest of the containment wall.
- Hapu:** Tribal group.
- Hazard:** A substance, activity, condition, situation or threat which has the potential to create or increase harm to people, property or the environment.
- Iwi:** Wider tribal group.
- Kaitiaki:** Traditional guardians of the land and natural environment.
- Kaitiakitanga:** The work and wisdom of kaitiaki.
- Leaching:** The chemical reactions that occur during the percolation of liquid through tailings or other materials. ‘Leachate’ is the product of leaching.
- Long-term:** For the purpose of this report, the long-term phase of managing tailings dams is considered to commence at the completion of the mine’s rehabilitation.

<b>Mahinga kai:</b>	Traditional food-gathering places.
<b>Mauri:</b>	Life force, intrinsic spiritual energies.
<b>Orphan site:</b>	A site which has been abandoned by the owner(s) or occupier(s), where no party can be fixed with legal liability, or where the liable party is unable to fund any maintenance or clean-up.
<b>pH:</b>	pH is a measure of acidity or alkalinity of a scale of 0 to 14 with pH 7 being neutral.
<b>Piezometer:</b>	An instrument used to measure groundwater water pressure and level.
<b>Pore pressure:</b>	The pressure of water that fills the pores in porous material.
<b>Pyrite:</b>	The most common sulphide material that is widespread in rocks affected by hydrothermal alteration.
<b>Pyritic tailings:</b>	Tailings containing a significant component of sulphide minerals, such as pyrite, that have potential to produce acid mine drainage.
<b>Rehabilitation:</b>	The processes used to stabilise areas of ground that have been disturbed during mining. It may include levelling, spreading topsoil, and establishing and maintaining vegetation. The purpose is to stabilise the area and provide a cover of self-supporting vegetation.
<b>Risk:</b>	A measure of the probability and severity of an adverse effect. In relation to tailings dams, risk includes the potential for structural damage to the dam leading to the discharge of tailings from the dam and contamination of surrounding land and water. It also includes the potential for environmental contamination by leachate due to poor design, siting, construction or maintenance of the dam.
<b>Tailings:</b>	Typically, the ground-up rock that remains after the commercial minerals or elements have been removed from the ore. Tailings are fine-grained, particulate solids often mixed with water to form a semi-fluid slurry for transport and mineral processing, then deposited in a settling pond. Depending on the nature of the rock from which they originated and on how they were processed, stored and managed, tailings have the potential to produce contaminated leachates containing high levels of acid, metals and cyanide.
<b>Tailings dam:</b>	A facility for the disposal and long-term storage of tailings and other waste materials from mining. The dam usually refers to the perimeter structure which impounds the tailings solids, slurry or slurry water.
<b>Tangata whenua:</b>	People of the land, people with ancestral links to a particular place or region.
<b>Taonga:</b>	Valued resources.

**Tino rangatiratanga:** Self-determination of iwi and hapu.

**Underdrainage:** A drainage system underneath the tailings which drains seepages from the impoundment.

**Urupa:** Burial sites.

**Waahi taonga:** Sites of special significance.

**Waahi tapu:** Sacred sites.

**Whakapapa:** Genealogy, ancestry, tribal identity.



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