

# PART THIRTEEN: NATURAL HAZARDS

## 1. INTRODUCTION

### 1.1 BACKGROUND

The Rotorua District experiences a range of natural hazards - including seismic, volcanic, hydrothermal and flood hazards - which may occur independently or as a result of one another. In places, the District is relatively sparsely populated and the effects of an extreme natural event may be minimal. In other areas, the District is relatively densely populated and the occurrence of an extreme natural event could have a substantial effect on people, buildings, infrastructure and the natural environment.

The Rotorua District geologically forms part of the Taupo Volcanic Zone which stretches from White Island in the north-east to Mount Ruapehu in the south-west. Within the Rotorua District there are major volcanic features including the Rotorua Caldera and the Okataina Volcanic Centre.

#### **Volcanic Zone**

The Taupo Volcanic Zone lies over an active “subduction zone” where two of the Earth’s crustal plates, the Indian Plate and the Pacific Plate, meet. The Pacific Plate is slowly being forced beneath the Indian Plate Zone. The movement of the plates causes great heat and pressure underground, and stretching of the Earth’s surface. This stretching results in “hot spots” where various forms of volcanic and geothermal activity occur.

The Rotorua Caldera is a large basin formed approximately 140,000 years ago when the ground collapsed after magma (molten rock) was erupted out from underneath it. Subsequent to the initial Caldera collapse, several volcanic domes were formed within the basin, including Mount Ngongotaha, Mokoia Island, Pukeroa Hill, Kawaha Point and Hinemoa Point. The Caldera is now partly filled by the water of Lake Rotorua. The Rotorua Urban Area occupies the southern end of the Caldera.

The Okataina Volcanic Centre lies between Rotorua and Kawerau. Its base is a large caldera formed by five or six huge eruptions and the subsequent collapse of the ground surface. During the last 50,000 years, the Caldera has been modified by the actions of over 40 vents within it. At various times these vents have erupted violent showers of ash and pumice, with thick lava flows and domes extruded following the explosive eruptions. Parts of the Okataina Caldera are

now filled by the water of lakes such as Lake Tarawera, Lake Okareka and Lake Okataina.

In areas within and surrounding the District's recognised thermal areas, there is always a possibility of hydrothermal eruptions. These eruptions occur if water at boiling point experiences a drop in pressure or if it comes into contact with rock at a higher temperature than itself, causing steam to be generated at very high rates. The expansion of steam is capable of producing explosions which can scatter debris over wide areas and form substantial craters.

### **Earthquakes**

As well as volcanic and geothermal activity, the underground pressure also causes earthquakes. Where extreme tension is experienced at a certain place, a point is reached when the pressure is released by snapping. Various earthquake "fault lines" exist where movement may occur. Most of the fault lines in the central North Island area extend in a north-east/south-west direction. The Rotorua District has a number of major and minor seismic fault lines within its boundaries. There is a particularly dense concentration of faults lying immediately south of the Rotorua Urban Area. Minor earthquake "swarms" (a succession of similarly sized earthquakes in a relatively short space of time) occur in the District periodically.

### **Erosion**

Surface erosion is not a serious problem in the Rotorua District when compared with the degree of erosion found in areas such as East Cape and Hawke's Bay. The existing climate, relief, geology, soils, vegetation and land uses of the Rotorua District are such that any erosion that does occur tends to be on a small scale. Some areas more susceptible to erosion (eg, steep gullies and river banks) have been allowed to revert to natural bush cover, or have been planted with indigenous or exotic tree species. This has helped to reduce the likelihood of erosion in those areas.

Landslips are an extreme form of erosion involving the rapid movement of large masses of material. The Rotorua District does not have a recent history of serious landslips. Small scale slips have occurred in some areas, but these have not been of the frequency or magnitude to constitute a serious hazard.

The soil and climate characteristics of some parts of the District are such that there is significant potential for underground erosion (where water wears away at materials under the ground surface, and where the surface may eventually collapse). Many parts of the District have "tomos" (large holes or vertical shafts created by erosion processes). Tomos can be a danger to stock and people, especially when the weight of a person or stock causes the ground surface to collapse suddenly, exposing a tomo.

### **Flooding**

The climate and relief of most of the Rotorua District is such that river flooding has not posed a major hazard. There has been some isolated small scale flooding from streams within the Urban Area, such as the Waingaehe (Holden's Bay), the Waiowhero (Kawaha Point) and the Utuhina (Koutu). There has also been some surface flooding after heavy rainfalls experienced in areas where existing stormwater drainage facilities have proved inadequate (eg Tilsley Street and the

Elizabeth Street/Phillip Street/Pererika Street area). Rural parts of the District such as Reporoa have also experienced some flooding in stream catchments.

### **Weather Patterns**

New Zealand is situated south of the area of the Pacific Ocean that has the warm surface temperatures necessary for tropical cyclones to form. The waters around New Zealand are colder than those further north, and this means that the majority of tropical cyclones lose intensity by the time they reach this country. However, occasionally cyclones do reach New Zealand or pass in close proximity. Severe climatic events of this type (such as Cyclone Bola in March 1988) cause very high levels of disruption. Although the impacts of Cyclone Bola were not as great in the Rotorua District as they were in other areas such as Northland and the North Island East Coast, they were still significant. Similar or even more serious impacts could occur in the District again in the event of further tropical cyclones.

### **Forested Areas**

Although agricultural and urban land uses predominate within the Rotorua Caldera, there are significant forested areas to the north, west and east of the Caldera with both indigenous and exotic species present. The Rotorua Urban Area is adjacent to a significant planted area, the Whakarewarewa Forest. Many rural settlements are in close proximity to areas of forest land. Most of the District's State Highways and other major road and rail transport routes run through areas of indigenous and/or exotic forest. Communication infrastructure and power lines are also associated with these forested areas. In the past forest fires have been contained by effective response mechanisms and have not presented a hazard.

## **1.2 SCOPE OF PART THIRTEEN**

The Objectives, Policies and Methods outlined in this District Plan for the avoidance or mitigation of natural hazards recognise that adjustments to natural hazards may be classified according to the effect of the hazard they target, the land use and management system, or the losses resulting from disasters. The hazard associated with river flooding, for example, may be adjusted by modifying either: the natural event (stop banking, river channelisation and catchment afforestation); the human use system (land use management, flood proofing of buildings, flood forecasting and warning, emergency programmes and community preparedness); or the losses (spreading the flood loss burden after an event through insurance and relief programmes). No one of the three approaches is necessarily the best for all types of hazards. All three may have a part to play in the management of a hazard. In many cases a combination of adjustment strategies creates greater hazard reduction capacity than does the adoption of separate adjustments.

## 2. RESOURCE MANAGEMENT ISSUE

### 2.1 ISSUE ONE

**NATURAL HAZARDS HAVE THE POTENTIAL TO CAUSE SIGNIFICANT ADVERSE EFFECTS ON THE ENVIRONMENT AND TO LIFE AND PROPERTY**

#### 2.1.1 ISSUE STATEMENT

There are a range of natural hazard issues in the Rotorua District which need to be provided for in order to effectively avoid or mitigate the potential adverse effects of those natural hazards. These issues can be grouped according to the natural event that can become a hazard.

##### 2.1.1.1 Volcanic Hazard Issues

Within the Rotorua District the danger posed by further volcanic activity in the Okataina Volcanic Centre, in particular, is significant. The volcanoes at Okataina have erupted relatively infrequently, at intervals of approximately 700 - 3,000 years. The most recent was the Tarawera eruption in 1886 AD. Some of these eruptions have been very large. This contrasts with some other New Zealand volcanoes, such as Mount Ngauruhoe and White Island, which tend to have eruptions of relatively small magnitudes quite frequently (every few months or years). Eruptions at Okataina are estimated to be 1,000 to 10,000 times larger than those at White Island or Mount Ngauruhoe. It is the magnitude of the eruptions at Okataina, despite their low probability of occurrence in any one year, which creates a significant volcanic hazard. The potential for volcanic activity similar to that which has occurred in the past, and the potential for damage to people, their property and other aspects of the environment is significant. Future volcanic activity in the Rotorua District may include dome building, pumice avalanches and showers, and explosive eruptions. Activity may not necessarily be limited to presently identified vents, and may occur anywhere in the District. Volcanic activity outside the District may also have the potential to cause significant adverse effects.

The effects of volcanic activity are characteristically large scale and widespread. For example, depending on factors such as the volume of erupted material and the direction and speed of wind, ashfall from a single volcanic eruption can spread over hundreds of square kilometres. It is thus difficult to Zone land in order to avoid or mitigate the effects of volcanic activity.

In order to effectively plan to reduce the risks from volcanic activity, it is necessary to know the extent of volcanic activity in the past, and the likelihood of similar activity occurring in the future. It is important to identify the areas where volcanic activity may occur, and, of those areas, those which are characterised by significant levels of human settlement and infrastructure. It needs to be recognised, when identifying areas subject to volcanic activity, that the effects of such activity are often spread over a substantial area. The Rotorua District could

experience serious effects (such as ashfall) of volcanic activity occurring well outside the District.

Information gathered to date on volcanic hazards in the Rotorua District has not pointed to any areas in demand for dense settlement that are at particular risk from more localised effects of volcanic activity (eg lava flows).

#### 2.1.1.2 **Seismic (Earthquake) Hazard Issues**

The primary adverse effects of earth movements can include damage to or failure of buildings, damage to building contents, roads, pipes and communication lines, personal injury and loss of human life. As well as these primary adverse effects, earthquakes may cause a range of secondary hazards, if they trigger other extreme events. For example, the movements associated with earthquakes may initiate hydrothermal eruptions (where geothermal systems are disrupted by earth movements), floods (where lake or river exits are blocked by earth movement causing water levels to rise, or where stopbanks are breached when cracked by earth movements), seiches (where water in lakes oscillates in large waves as a result of earth movements under or surrounding the water), landslips (an extreme form of erosion involving the rapid movement of large amounts of material) and liquefaction (which occurs in saturated soils when, as a result of earthquake shaking, the soil particles are rearranged and the mixture of soil and water acts as a liquid, rather than a solid).

In the Rotorua District there is significant potential for secondary hazards triggered by earth movements, because there are areas of hydrothermal activity, volcanic features and many lakes and rivers, most of which are associated in some ways with human settlement and other uses of the natural environment.

There are a number of limitations on identifying areas at particular risk from seismic activity and secondary hazards in the Rotorua District. For example, the sediments of the Rotorua District are young and comparatively thick. This may mean that the existence of some fault lines is masked. In addition, earth movements associated with movement along a particular fault line can have impacts in a greater area than that immediately associated with the fault line itself.

#### 2.1.1.3 **Geothermal And Hydrothermal Hazard Issues**

Certain activities have the potential to increase the potential hazards associated with geothermal and hydrothermal activity. For example, excavation and filling of geothermal surface features may interfere with the geothermal systems, and cause abrupt increases in surface activity, including sudden explosions. Hydrothermal eruptions are most likely to occur in places where the geothermal aquifer is at or very close to the surface. In the past they have occurred in and near areas such as Whakarewarewa, Ohinemutu and Kuirau Park. In areas where the geothermal aquifer is well below the surface, the possibility of hydrothermal eruption is low. However, if earthquakes occur which rupture the earth to below the level of the water table, the sudden pressure release could be accompanied by hydrothermal eruptions.

Associated with the danger of hydrothermal eruptions in thermal areas are the geothermal hazards of ground subsidence and hydrogen sulphide gas emission. If caves exist underground in thermal areas, weakening of the ground can occur by steam and/or acid condensate, resulting in the collapse of the caves. There have been examples of this happening in some of the District's thermal areas.

Hydrogen sulphide gas can be emitted from the ground, and even with low levels of emission, gas can build up to lethal levels in holes and poorly ventilated spaces such as closed sheds and garages.

As well as the dangers posed by the possibilities of geothermal/ hydrothermal events occurring naturally within the Rotorua District, there also exist geothermal and hydrothermal hazards which are human generated. These are related to the technological development of geothermal energy use which became significant on a large scale in the early 1950s and has since continued to the present time. Disused geothermal production bores and soak holes are the hazards in question. The location of many of the earlier bores and soak holes was never accurately recorded. In many cases, when they were no longer useful they were abandoned without first being made safe. Associated with these disused facilities are the possibilities of ground collapse and uncontrolled emissions of hot water, steam and other gases.

The areas affected by geothermal and hydrothermal hazards are limited to relatively localised parts of the Rotorua District. However, most of the affected areas are presently associated with substantial residential and commercial activities or recreation activities. There is thus significant potential for damage to people and property as a result of geothermal and hydrothermal activity.

Hydrothermal eruptions, ground subsidence and gas emissions tend to be localised, affecting a limited number of properties and people. There is potential, however, for them to occur in quite densely populated areas such as Fenton Park and some parts of the Central Business District where there are already significant existing levels of residential and commercial activities in areas affected by geothermal and hydrothermal activity.

The geothermal and hydrothermal activity which poses a hazard also provides a significant resource. It is utilised in various ways for tourism, bathing, cooking and heating.

#### 2.1.1.4 **Storm Hazard Issues**

If accelerated global warming and associated changes in climatic conditions occur in the future, as has been suggested by a large number of scientists, it may be that the area of warm, cyclone generated surface waters of the Pacific Ocean will expand southwards by several degrees latitude. New Zealand would still lie south of this area, but it could be that cyclones will reach or pass close by New Zealand with increased frequency. Rotorua, like other centres, would be affected by this increased frequency of cyclonic events.

#### 2.1.1.5 **Flood Hazard Issues**

Surface flooding associated with high lake levels has been experienced at lake edge properties in areas such as Hamurana and Ngongotaha (Lake Rotorua) and Mourea (Lake Rotoiti/Ohau Channel). The levels of lakes in the District have fluctuated over thousands of years in the past, and there is the possibility that extensive flooding could occur as a result of rising lake levels. This is especially likely in the event of seismic or volcanic activity blocking lake exits such as the Ohau Channel, the Tarawera River or the Kaituna River. Floods could also arise from volcanic activity breaking the divides separating lakes (eg Lake Okataina and Lake Tarawera; Lake Rotoiti, Lake Rotoehu and Lake Rotoma). Seiches (where water oscillates in large waves as a result of earth movements under or

near the water) also have the potential to cause significant flooding in lakeside areas.

The regional councils and their predecessors and the Rotorua District Council have, in the past, been involved with developing such maintenance and engineering works, for instance, floodways, stream channelisation, stop banks and stormwater systems to reduce flooding in the District. As a result, many of Lake Rotorua's tributary streams have structural flood works in place to reduce flooding up to particular design levels. The Ngongotaha and Waingaehe Streams, for instance, both have stream diversion cuts to reduce the volume of water flowing down the natural stream courses. However, much of Rotorua's flood hazard results from stormwater systems that are under capacity.

#### 2.1.1.6 **Erosion And Landslip Issues**

The characteristics of the Rotorua District are such that the potential for damage to human life and property from landslips is relatively small. However, landslip is one of the secondary hazards which may be initiated by earthquakes. The Hemo Gorge, south of the Rotorua Urban Area, is one place in the District where landslips could occur in the event of earth movements disturbing the underlying geology. State Highway 5 passes through the Hemo Gorge, and in the event of a large scale landslip, road links with other parts of the country could be interrupted for some time.

Though the potential for serious erosion in the District is small, it could increase in the future if there are significant changes in climate, vegetative cover or land use. So that land management practices can be encouraged to reduce the likelihood of damage from erosion and landslip, it is necessary to identify those areas that may be particularly susceptible.

#### 2.1.1.7 **Fire Hazard Issue**

Substantial areas of the Rotorua District are forested, with both indigenous and exotic species present. Given the presence of such large forested areas, there is a hazard associated with forest fires, especially in the late summer/early autumn periods. The degree of recreational and tourist use of the forests of the District is high. This increases the potential for fires to occur.

It is not just areas of forest land that are in danger from forest fires. Areas of human settlement and associated forms of land use and infrastructure may be impacted by serious forest fires. The Rotorua Urban Area is adjacent to a significant planted area, the Whakarewarewa Forest. Many rural settlements are in close proximity to areas of forest land. Most of the District's State Highways and other major road and rail transport routes run through areas of indigenous and/or exotic forest. Communication infrastructure and power lines are also associated with these forested areas and are at risk from damage by fire.

The District Council has responsibility for responding to fires in the District which are not dealt with by the New Zealand Fire Service (Urban Area) or the Department of Conservation (Crown Land).

#### 2.1.1.8 **Drought Hazard Issue**

For a number of reasons, including its amount of rainfall, wind, its temperatures, soil types and land uses, the Rotorua District tends not to have severe droughts with the serious impacts that those in some other parts of the country do. The

climatic drought hazard faced in the Rotorua District is minimal when compared with that of some other areas of New Zealand. Climatic data confirms this.

However, there is always a possibility of drought becoming a problem in the future, as a result of either fluctuations or changes in climate, or changes in land use management. There are a range of organisations that would be involved in strategies to manage a drought. They includes regional councils, the Ministry of Agriculture and Fisheries, Federated Farmers and insurance companies. The Rotorua District Council will liaise with such groups at the time of a drought or impending drought to determine the most appropriate role for Council.

### 2.1.2 RESOURCE MANAGEMENT OBJECTIVES

- (a) *A civil defence system that allows the community and District to effectively respond to natural hazards***
- (b) *Land use and management practices that avoid or mitigate the potential adverse effects of natural hazards***

### 2.1.3 POLICIES

The Objectives in **2.1.2** of this Part will be achieved by a combination of policies which recognise that if the avoidance or mitigation of natural hazards is to be effectively achieved in the Rotorua District then certain actions will be required.

There is insufficient information available on the extent and nature of natural hazards in the Rotorua District. It is also difficult to accurately predict where some natural hazards will occur. For example, there are difficulties in the identification of fault lines in some areas of the District (eg, in the Rotorua Caldera).

#### **Research**

Before measures can be successfully adopted for avoiding or mitigating the natural hazards that exist in the Rotorua District, it is necessary to identify those areas where natural hazards have occurred or may occur. The more information that becomes available to Council, the more able it will be to effectively plan for natural hazards and the issues that arise from them.

Although there are limitations, a “lifeline” scenario technique has been used effectively in some other parts of New Zealand with significant seismic hazards. It will be applied to the Rotorua District as part of Council’s information gathering strategy. The technique involves developing a scenario of effects around a hypothetical seismic event, to highlight existing weaknesses in the siting of lifelines such as major roads, pipelines and communication lines and to identify areas where such lifelines should not be sited. Similar scenario studies may also identify places where limitations should be placed on the building that is allowed. Until such studies are undertaken, however, Council’s land use management strategy will focus on the enforcement of generalised building standards to ensure that buildings can withstand seismic movement up to a certain level.

For the development of effective public awareness programmes and land use and management strategies, areas in the District which are likely to be affected by significant natural hazards and secondary hazards need to be identified. It is particularly important to identify those areas characterised both by potential for significant natural hazard activity and/or secondary hazards, and by significant levels of building and infrastructure, so that those areas are given priority for hazard avoidance or mitigation strategies.

### **Information Sharing**

Liaison between agencies with roles in the management of natural hazards is important. It facilitates the sharing of information and ideas on the most effective ways of managing the risks (before, during and after a natural hazard occurs). It also makes coordinated responses to natural hazards (which tend to be more effective than a series of fragmented responses where a natural event has cross boundary effects) more likely.

Council can carry out such liaison by, for example, responding to the natural hazards components of other councils' proposed policy statements and plans, and by transferring information to and receiving information from other agencies. Council can, in addition, consider jointly funding research on natural hazards with other agencies, and developing joint strategies, where appropriate, for natural hazards management.

One way that research work can be utilised is through transferring any relevant information on natural hazards to Council's Hazard Register and, where appropriate, into property files. This will allow Council staff and the public ready access to the information and ensure that the information issued in the day to day management and control of building and infrastructure development in the District is as up to date as possible.

A particularly effective way of avoiding the effects of natural hazards and secondary hazards is to ensure that the siting and construction of buildings and infrastructure takes account of areas where the potential for natural hazards and related activity exists. This can be done by, for example, making sure that major roads, transmission lines and pipes do not traverse major fault lines (The Rotorua Civil Defence Plan contains a map of major faultlines in the District).

### **Geothermal and Hydrothermal Activity**

In order to effectively plan to reduce the risks from geothermal and hydrothermal activity, it is important to establish those areas that are vulnerable to hydrothermal eruptions, ground subsidence and gas emissions, and particularly those vulnerable areas that are also presently used or zoned for residential or commercial purposes.

### **Storms**

It would be impractical to develop formal land use management or zoning strategies to avoid or mitigate the effects of storms in the District, given the variable spatial nature of impacts. However, certain land use practices may help to reduce the effects of high winds and rain that are associated with storms, such as, catchment treatment measures that are appropriate for reducing flooding, erosion and landslip.

**Flooding, Erosion and Landslips**

One of the most effective ways of reducing risks from flooding, erosion and landslips involves carrying out catchment measures such as tree planting and gully retirement, prevention of forest fires, small scale retention dams (including farm ponds) and the protection of land from over grazing. The regional councils have major catchment treatment programmes in place (for example, the Bay of Plenty Regional Council's Upper Kaituna Catchment Control Scheme and Waikato Regional Council's Paeroa Range Catchment Control Scheme). The District Council has financial input into these schemes. Various provisions of the Rural Zones in this District Plan also promote catchment treatment measures.

**Drought**

At this stage, the potential for drought is not seen to be serious enough to warrant Council involvement. This position is seen to be acceptable under Section 32 of the *Resource Management Act 1991* which confirms the acceptability of taking no action on a matter if it seems unwarranted.

- 2.1.3.1 **Policy:**  
*To identify and assess natural hazards in the District by undertaking research and by assessing the potential effects of natural hazards on people, property and other aspects of the environment.*
- 2.1.3.2 **Policy:**  
*To encourage the development of effective responses to natural hazards.*
- 2.1.3.3 **Policy:**  
*To raise public awareness of natural hazards in the District.*
- 2.1.3.4 **Policy:**  
*To facilitate a reduction in the potential for damage to buildings and property resulting from natural hazards.*
- 2.1.3.5 **Policy:**  
*To ensure that activities do not increase the likelihood or intensity of natural hazards.*
- 2.1.3.6 **Policy:**  
*To take no action to avoid or mitigate drought hazard in the District at the present time, but in the event of a drought or an impending drought, to liaise with appropriate groups to determine an appropriate role for Council.*
- 2.1.3.7 **Policy:**  
*To assess applications for resource consents against information on natural hazards, in order to avoid or mitigate those hazards.*

## 2.1.4 METHODS OF IMPLEMENTATION

### 2.1.4.1 Research

The Rotorua District Council will liaise with other relevant agencies (eg the regional councils, neighbouring district councils and the Institute of Geological and Nuclear Sciences) for the sharing of relevant information on natural hazards and effective ways of avoiding or mitigating them.

During the life of this District Plan, Council will undertake research, in conjunction with the Institute of Geological and Nuclear Sciences and other appropriate agencies, to assess the potential of natural hazards in the District and develop strategies to avoid or mitigate its effects. The work will include:

- (i) gathering information on potential locations of natural hazards;
- (ii) estimating the effects that natural events could have (including developing scenarios around hypothetical natural events to identify particular problems with vital infrastructure such as roads and communication facilities); and
- (iii) developing strategies to avoid and mitigate hazards associated with natural events, where practicable.

A computer modelling programme is being used to model the effect of rain events on the Urban Area's stormwater systems. The model can be used to give approximate overflow levels where the capacity of the stormwater system is exceeded. Assessments of flood levels and frequencies in rural catchments of the District can also be developed. The stormwater modelling programme mentioned is being used to assess priority areas for upgrading in the Urban Area.

Other research to be undertaken by Council includes:

- The development of natural hazard maps for the District during the District Plan period;
- The development of assessments of flood levels and frequencies in rural catchments of the District; and
- An assessment of ways in which damage to lifelines (such as roads, pipelines and communication links) resulting from seismic and related activity can be avoided or mitigated by carrying out a lifeline scenario study for the Rotorua District.

### 2.1.4.2 Civil Defence

The Rotorua District Civil Defence Plan has a status separate from the Rotorua District Plan. However, the Civil Defence Plan is part of the District Council's response to natural hazards and outlines warning systems, response strategies and disaster recovery mechanisms for natural hazards. As such, reference to the need for on going development and monitoring of the Civil Defence Plan and its strategies for responding to natural hazards is made in this District Plan. Council will revise and update its Civil Defence Plan every 3 years.

As well as maintaining the Rotorua District Civil Defence Plan, the Rotorua Civil Defence organisation also has important functions in the implementation of natural hazard public awareness programmes and the coordination of its plans for response to natural hazards with the responses of neighbouring district councils (as specified in the Rotorua District Civil Defence Plan), Environment BOP and other related agencies. The Rotorua Civil Defence organisation will continue to liaise with other relevant agencies to ensure that its responses to natural hazards can be effectively coordinated, where necessary, with the responses of other agencies.

The role of the Civil Defence organisation in raising public awareness of natural hazards is clearly important, given that organisation's responsibilities when extreme natural events (for example, volcanic eruptions and earthquakes) occur. It is primarily through the development of Civil Defence programmes (including the Rotorua District Civil Defence Plan) that Council will play a part in raising public awareness about natural hazards. As part of this, surveys will be carried out to ascertain people's perceptions of natural hazards, so that Civil Defence public awareness programmes can be tailored to suit existing levels of understanding.

#### 2.1.4.3 **Rural Fire Plan**

Council will continue to maintain an up to date Rural Fire Plan for the District. Council has a Rural Fire Plan which shows what staff should do initially in the event of a fire being reported, people to contact, available resources and organisation. The delivery of service for the control and suppression of rural fires in the District is provided by the "Castlecorp" division of Council.

#### 2.1.4.4 **Education and Public Awareness**

There is a role for Council in supporting programmes that encourage people to take up hazard mitigation strategies. There is also a role for Council in providing and supporting initiatives for raising public awareness of the potential for natural hazards in the District and of the range and extent of practices that may be effective in reducing the hazards.

Council will carry out studies of people's perceptions of natural hazards in the District so that Civil Defence education programmes can be tailored to meet the needs of the District community. It will also support and develop awareness programmes that help to highlight the importance of catchment treatment and careful land management practices in avoiding or mitigating flooding, erosion and landslip, by having a role in the "Environmental Plans" programme.

There are a number of things people can do to lessen the risks to themselves and their properties from natural hazards. One of the most effective ways of avoiding and mitigating the effects of natural hazards is by people responding when a serious natural hazard is imminent or in its early stages. To increase the likelihood of people responding effectively to imminent natural hazards, it is important that they are made aware of what they should do and why. Effective emergency strategies that people can implement before and during natural hazards that will help them to survive that hazard include preparing a survival kit, knowing how to turn off electricity, gas and water, and preparing home and workplace evacuation plans.

Though the flood hazards associated with the Rotorua District are comparatively small, there is a place for education programmes aimed at those in flood prone areas about the measures they can take to decrease the hazards posed by flooding. Individual actions that can avoid or mitigate flood hazard include insurance and emergency preparedness (such as plans for moving stock to higher ground and shifting the contents of buildings out of the reach of flood waters).

Because of the characteristic sudden onset of hydrothermal eruptions, ground subsidence and gas emissions, there is little scope for developing and publicising early forecasting and warning systems. However, people living in areas susceptible to geothermal/hydrothermal hazards can be made aware of the dangers that exist and be encouraged to take precautionary actions, such as preparing survival kits and planning home and workplace evacuation strategies, especially in areas where there is potential for large scale ongoing activity.

Council has a role in supporting and developing public awareness programmes for the reduction of erosion and landslips. In particular, there is benefit in Council supporting the promotion of catchment treatment and land use management practices. One way Council will be doing this during the life of this District Plan will be by exercising a role in the “Environmental Plans” programme, which, among other things, seeks to encourage rural land owners to carry out catchment treatment measures and employ careful land management practices (see **Part Ten** of this Plan).

#### 2.1.4.5

##### **Rules**

When resource consents are applied for where natural hazards are a known risk Council may wish to assess the application in a manner that will avoid or mitigate the adverse effects of natural hazards and ensure that the application does not contribute to the natural hazard.

Section 106 of the *Resource Management Act 1991* gives Council the ability to refuse to grant a subdivision consent if the land is likely to be affected by flooding, erosion, subsidence and slippage, although consent may be granted if Council is satisfied that sufficient provisions have been made to avoid, remedy or mitigate the hazard (as appropriate in the circumstances) through means such as District Plan Rules, conditions on resource consents (including requirements for catchment control measures) and works. To this end the requirements for subdivision that are part of this District Plan (**Part Sixteen**) include standards for stormwater and land drainage to reduce the likelihood of erosion, subsidence, slippage and inundation.

Section 76 of the *Resource Management Act 1991* makes provision for Rules or criteria to be made to protect other property from the effects of surface water, which are additional to, or more restrictive than, those specified in the building code. Such additional Rules or criteria will be applied where necessary in the District. Subdivisions, where required, must incorporate a piped primary system capable of carrying surface water resulting from a storm having a 10% chance of occurring annually, and a surface secondary flow system capable of carrying surface water resulting from a storm having a 2% chance of occurring annually to ensure that surface water does not enter buildings.

Specific rules have been included elsewhere in the plan which will assist in mitigating hazards. In **Part Ten** of the Plan, rules have been put in place

requiring a separation distance of 20 metres between any plantation forestry and certain residential activities. Such a separation distance reduces the likelihood of the spread of ground fires.

#### 2.1.4.6 **Building Act and Regulations**

Council enforces regulations governing the structural standards that buildings must comply with under the *Building Act 1991*. These standards were developed to take account of, among other things, the effects of natural hazards on buildings. These provisions may be further used in the future to manage land use in areas of the Rotorua District that are subject to flooding, erosion, slippage and certain other hazards.

The *Building Act 1991* gives territorial authorities control over the granting of consents for buildings subject to a range of hazards, including flooding. The *Building Regulations 1992* include performance standards for building construction designed to reduce risks from surface flooding.

Section 36 of the *Building Act 1991* requires the District Council to refuse to grant a building consent where the land is at risk from inundation, unless the Council is satisfied that adequate steps have been taken to protect the land or buildings. The District Council enforces the requirements of the *Building Regulations 1992* which include performance standards that require the protection of property from surface water resulting from storms with a 10% chance of occurring annually (65% chance of happening in any 10 year period) and the protection of buildings from surface water resulting from storms with a 2% chance of occurring annually (18% chance of happening in any 10 year period).

It should be recognised that the provisions of the *Building Act 1991*, and the *Building Regulations 1992* outlined here, apply to instances of new building construction and major alterations to buildings. Where development has already taken place in areas subject to natural hazards, other measures to avoid or mitigate the hazards, such as works and services and public awareness programmes will have to be relied upon.

#### 2.1.4.7 **Proposed Rotorua Geothermal Regional Plan**

The Proposed Rotorua Geothermal Regional Plan produced by Environment BOP includes Rules for that part of the District covered by the Rotorua Geothermal Field, which require such activities to be assessed as Discretionary Activities requiring resource consents from Environment BOP. Because such activities do have the potential to increase geothermal and hydrothermal hazards, these Rules have been extended to cover the entire District in this District Plan. The District Council will administer the provisions, assessing such activities as Discretionary Activities, except in those parts of the District where either a resource consent for the same activity is required by a regional council or for those activities that are carried out in accordance with Schedule 8 - Ohaaki Geothermal Power Station, Part Seventeen of this District Plan.

Council will consider the following activities as activities causing natural hazards:

- Any interference with the natural geothermal fluid outflow from a geothermal surface feature;

- Any interference with the physical structure of a geothermal feature;
- Any destruction of a geothermal feature including excavation;
- Any placement or deposition of any substance, including fill or waste material on, into, or under any geothermal surface feature.

These activities shall be considered as activities causing natural hazards requiring avoidance or mitigation, and as having an adverse effect on the environment. They shall be treated as discretionary activities requiring consent from the District Council, unless a resource consent for the same activity has been obtained from a regional council or the activities are carried out in accordance with Schedule 8 - Ohaaki Geothermal Power Station, Part Seventeen of this District Plan. In such cases these activities shall be treated as a permitted activities.

#### 2.1.4.8 **Catchment Treatment Measures**

Council will promote catchment treatment measures as a means for avoiding or mitigating flooding, erosion and landslips, by administering those provisions of the Rural Zones (including the ability to place conditions on resource consents) that promote catchment treatment.

#### 2.1.4.9 **Works for the Avoidance of Flooding**

The continued development and maintenance of engineering works such as floodways, stream channelisation, stop banks and stormwater systems is one method of reducing the severity of flood events. As much of Rotorua's flood hazard results from stormwater systems that are under capacity, Council has a commitment to carrying out a stormwater upgrading programme.

Council will mitigate flood hazard in the District by carrying out and supporting the development of flood works where appropriate, and by carrying out an upgrading programme for the stormwater systems in the Urban Area.

While works for the avoidance of flooding may have the positive effect of reducing the severity of flood events up to a certain design level, some such works may have adverse effects on the environment. For example, stop banks and stream channelisation may alter the natural course of waterways, adversely affecting the natural character and ecological values of those waterways. Rules have been included in other sections of the Plan to ensure that works for the avoidance of flooding is allowed subject to performance standards to ensure that adverse effects on the environment are avoided, remedied or mitigated.

### 2.1.5 **ANTICIPATED ENVIRONMENTAL RESULTS**

The Objectives, Policies and Methods of Implementation set out in **2.1** of this Part are intended to achieve the following environmental results:

- more information available on natural hazards within the District;
- identification of areas which are susceptible to natural hazards;

- improved assessment of the potential effects of natural hazards on life, property and the environment;
- the coordinated and integrated management of natural hazards strategies both within and across territorial boundaries;
- better communication with other agencies with roles in hazard management;
- increased public awareness of natural hazards;
- continued improvement of civil defence plans and programmes; and
- suitable land use and management practices in areas identified as being susceptible to natural hazards.