Auckland Regional Council

09

OUR REGION, OUR FUTURE

State of the Auckland Region

Auckland Regional Council
TE RAUHĪTANGA TAIAO

5.0

Hazards and heritage

Part 5 discusses the types of natural hazards that threaten the Auckland region, our current knowledge about these and the impact of recent natural hazard events on communities and councils, and what we are doing to plan for and lessen the impact of such events.

It also discusses the state of our heritage and our knowledge about historically significant buildings, places and landscapes, including those of special cultural significance to Māori. It outlines the threats that could endanger different aspects of our heritage and the measures that we are taking to preserve it.

5.1

Hazards and heritage – Natural hazards

Contents 5.1

Photo: Browns Island, Auckland. (Source: ARC).

Natural hazards

Introduction

A natural hazard event is any physical environmental process that adversely affects people and/or property. Natural hazards can have severe direct (e.g. death, injury, property damage) and indirect (e.g. loss of income, economic disruption) impacts on people within the Auckland region.

The Auckland region is exposed to a wide range of natural hazards. These can be broadly categorised as:

- Geological. Including earthquakes and volcanic eruptions. These are created by the earth's massive internal pressures releasing energy at the surface. These events occur only occasionally but can impact large areas of the region (landslides can be triggered by earthquakes but occur more frequently in response to climatic processes).
- Climatic. Including landslides (triggered by rainfall), cyclones, floods, droughts and tornados. These hazards occur frequently in the region although their impact is often localised. On occasions a number of these hazards can occur simultaneously. For instance, a cyclone event can cause flooding, landslides, coastal erosion and coastal flooding throughout the region.
- Coastal. Including beach and cliff erosion, coastal flooding and tsunami. Coastal erosion is an ongoing issue for the Auckland region. It is a natural process but becomes a hazard when it threatens or damages development near the coastline.

Each type of natural hazard has distinct characteristics that influence the location, frequency and magnitude of an event. The severity of hazard events varies across the region over time due to factors that include the local environmental (natural and human) conditions and external influences such as climate change (see Climate change in Part 1).

Natural hazards are difficult, or sometimes impossible to control but land use activities that alter the existing environmental conditions can sometimes exacerbate the impact of events. For example, landscape modifications of a steep hill can increase the likelihood of a landslide. Exposure to natural hazards in the Auckland region is consequently determined by a complex interaction between natural processes and human activities.

The risks to communities can be reduced by an improved understanding of each type of natural hazard and its impacts, coupled with effective planning to avoid or mitigate their adverse effects.

Natural hazards monitoring programmes

Various monitoring and research networks within the Auckland region provide data on the frequency and magnitude of natural hazards. Some natural hazards result from natural physical processes that are difficult to research directly (such as cyclones) but we are able to monitor the probability and likely impact of the hazards (such as floods and landslides) associated with that process. More details are provided in the appropriate sections.

Geological hazards

Earthquakes

The Auckland region is located close to the boundary of the Australian and Pacific tectonic plates. As these two plates move over each other, strain builds up in the earth's crust and is released along fault lines, causing a tectonic earthquake. Earthquakes can also be caused, although less frequently, by magma rising toward the earth's surface before a volcanic eruption. In comparison to the rest of New Zealand, the magnitude of earthquakes in the Auckland region is generally small and most are undetected by the public.

There are two active fault lines in the Auckland region: the Wairoa North Fault (in Manukau City/Franklin District) and the Drury Fault (in the Papakura/Franklin districts). Movement along these fault lines occurs about every 13,000 to 43,000 years. Immediately outside the Auckland region, the Kerepehi Fault in the Waikato region experiences movement about once every 2500 years. If movement along this fault line caused an earthquake within the Hauraki Gulf area, it could potentially generate a small tsunami and produce significant ground shaking in the southern part of the Auckland region. Areas of land with deep alluvial sediments close to this fault line, such as the Manukau Lowlands, would experience significant ground shaking as the loosely compacted sediments would amplify the earthquake energy moving through the earth.

The probability of the Auckland region experiencing an earthquake with a ground shaking intensity exceeding the Mercalli Scale (MM) rating of VI is once every 90 years, while an earthquake of VIII (or greater) is expected once every 5400 years. The MM scale grades the impact of an earthquake on people and the community. An earthquake of MM VIII is expected to cause panic amongst people and extensive damage to buildings, especially when these are located on alluvial sediments.

Earthquake monitoring programme

In 1995 a network of seismometers was set up to monitor earthquake within the Auckland region (see volcanic seismic monitoring program).

Indicator 1: Number and impact of earthquakes

Earthquakes in the Auckland region are measured using the Richter Scale (M) which determines the energy that is released. From 2004 to 2008, 27 earthquakes exceeding M2 were detected in the Auckland region. Most earthquakes were less than M 3 and did not release enough energy to be felt, but one M 4.5 earthquake on 21 February 2007 was felt widely through the Auckland region, particularly in Rodney District and North Shore City. It was located 6km east of Orewa, at a shallow depth of 5km below the earth's surface (Figure 1). This earthquake was part of a swarm of ten separate earthquakes that occurred within a 24 hour period. It did not cause any injuries to people but did cause many cases of minor damage to houses (particularly brick chimneys and walls) and their contents. A total insurance payout of $1.5 million was made, with 495 damage claims reported. The majority of insurance claims were from residential properties in Rodney District and North Shore City.

5.1

Natural hazards

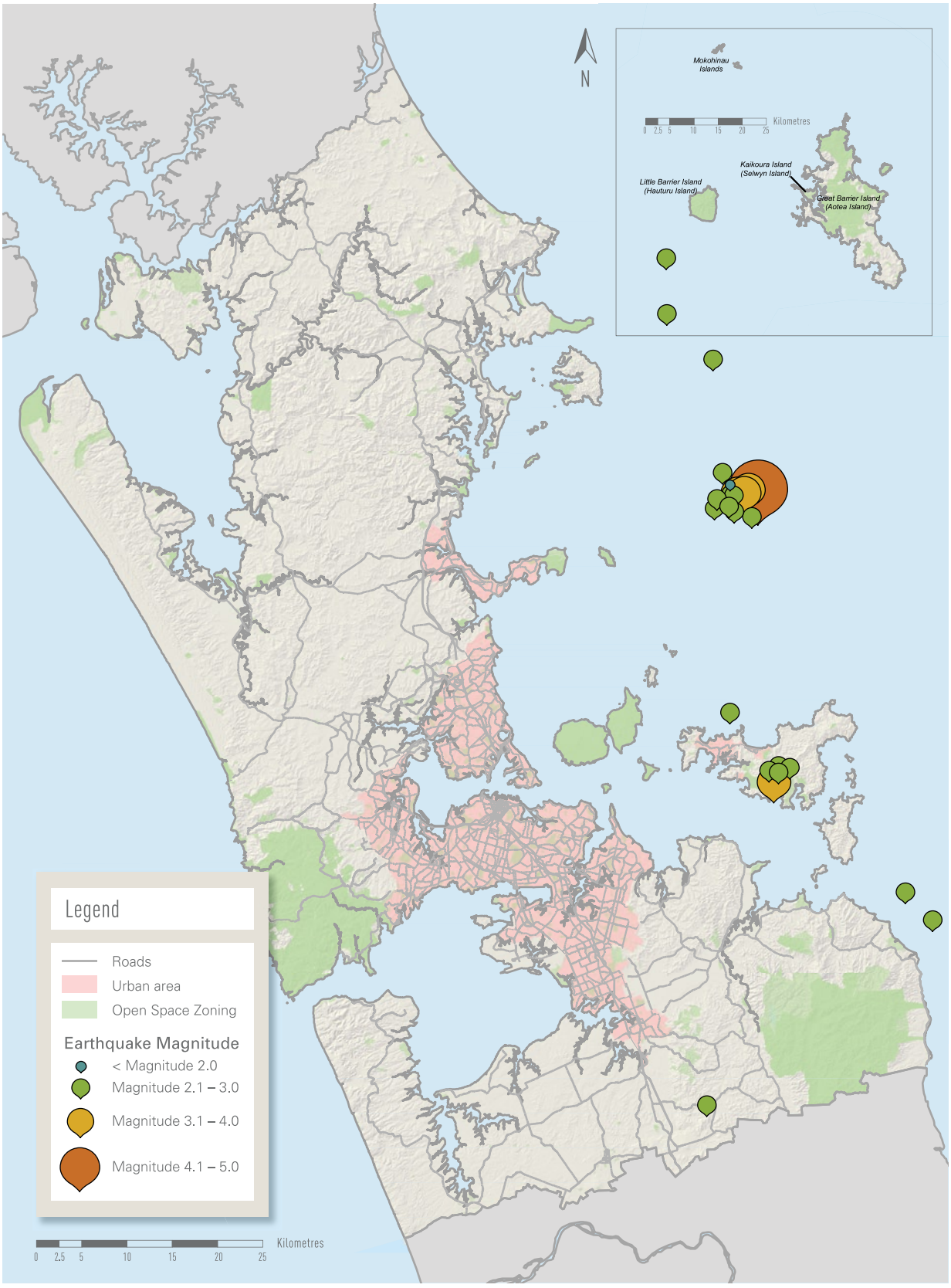

FIGURE 1 Locations and magnitudes of the earthquake swarm in February 2007. (Source: GIS Information Services ARC).

Natural hazards

Volcanic eruptions

The Auckland region is vulnerable to hazards associated with volcanic eruptions in the Auckland Volcanic Field (AVF), the Taupo Volcanic Zone (TVZ) and Mt Taranaki. Most of the Auckland urban area is located on the potentially active AVF. Rangitoto Island was the largest and most recent eruption in the AVF, having formed during two separate eruption events approximately 600 years ago. Eruptions in the AVF are unpredictable with each new event most likely to occur at a new location at any time.

During the last 200,000 years 49 volcanic eruptions have occurred in the AVF. This means that an eruption has occurred, on average, once every 5000 years. The AVF has however experienced periods of increased activity, with up to five eruptions occurring within 100 years (an average return period of once every 20 years) about 30,000 years ago.

Volcanic activity in other parts of the North Island can also affect the Auckland region. Past eruptions from the TVZ and from Mt Taranaki have deposited layers of volcanic ash ranging in thickness from 1mm to 63mm. Over the last 80,000 years, ashfall from these volcanoes has been deposited in the Auckland region once every 750 years, on average. This figure excludes potentially more frequent, smaller ashfall events that can be hazardous to people and infrastructure but are not preserved in the region's geological record. For example in 1996 a small eruption from Mt Ruapehu in the central North Island dispersed sufficient volcanic ash to close Auckland International Airport for three nights.

Recent studies have highlighted the impacts of a volcanic eruption on the people, buildings and infrastructure of the Auckland region (Table 1). The potential level of injuries and deaths from an eruption in the AVF is difficult to determine, as these depend on the ability to predict the eruption site and the time available for the emergency services to undertake large scale evacuations. Injuries and deaths during an eruption would be restricted to people who are unable to be evacuated (e.g. the critically ill or infirmed), refused to leave or have returned to their home and those involved in emergency management.

TABLE 1 Possible level of disruption to people, businesses and employment from a Rangitoto-sized eruption superimposed on volcanic cones in urban areas of the Auckland region. (Source: ARC).

Location	3km radius from vent			5km radius from vent		
	Population	Businesses	Employees	Population	Businesses	Employees
Mt Wellington – Maungarei	61,119	5,606	31,117	151,824	16,759	88,152
North Head – Maungauika	16,206	1,884	7,600	67,338	15,138	81,820
Mangere Mountain – Te Pane O Mataoho	32,103	2,556	19,103	101,121	8,367	66,380
Mt Eden – Maungawhau	99,912	19804	113549	222,579	38,462	203,845

The amount of damage to buildings and infrastructure would depend upon their proximity to an eruption. Most buildings and infrastructure within 3km of an AVF eruption vent would suffer complete or extensive damage with costs exceeding billions of dollars.

A local or distant eruption event that dispersed a thin layer of volcanic ash across the whole of the Auckland region could affect about 240,000 residential buildings and cause about $140 million of non-structural damage. These costs will substantially increase when further considering damage to infrastructure (e.g. water supply, electricity, gas, transport systems), as well as commercial and industrial buildings.

Modelling the economic impact of an AVF eruption suggests that the Auckland region would suffer a 47 per cent reduction in GDP (reducing to 40 per cent if business mitigation responses are implemented) and result in a 14 per cent decline in the national GDP (reducing to 12 per cent with business mitigation response). Overall, the economic impact could be more severe than the Great Depression in the early 1930s, when national economic growth rates declined by 7 per cent. Employment in the Auckland region may be expected to reduce by 268,000 jobs (48 per cent) although this could be reduced if business mitigation responses are applied.

Volcanic seismic monitoring programme

Volcanic seismic monitoring is carried out by GNS Science, a New Zealand government-owned research organisation specialising in geological and nuclear science. The regional volcanic seismic monitoring network contains seven seismometers located around the AVF, recording seismic activity as an indicator for an imminent volcanic eruption.

Indicator 2: Number and impact of volcanic eruptions

Since 2004, the AVF has not experienced any volcanic activity near to the earth's surface (i.e. no earthquakes detected due to the movement of magma). In addition, no eruptions in the central North Island have created sufficient ashfall to affect the Auckland. Therefore, no human harm or damage occurred as a result of volcanic eruptions from 2004 to 2008.

5.1

Natural hazards

Climatic hazards

Cyclones

Cyclones are extreme, low pressure weather systems that can inflict a range of natural hazards including high winds, flooding, landslides triggered by heavy rainfall, and storm surges that cause coastal flooding and erosion.

The Auckland region's cyclone season tends to occur between December and April when cyclones move towards the area from equatorial latitudes. There is an 80 per cent chance of a cyclone passing within 500km of the Auckland coast each year. Research suggests that the probability of the Auckland region experiencing a cyclone increases during La Niña weather conditions when north-easterly storms are more frequent (see Weather and climate in Introduction, pg 10).

Indicator 3: Number and impact of cyclones

Since 2004, no cyclone events have impacted the Auckland region.

Floods

Floods occur when heavy rainfall fills waterways beyond their normal capacity or saturates soil to a point where it cannot hold any more water, forcing the water to flow over the surface. In the Auckland region, flood events are recorded from river flow (mean annual flood discharge in m^3) or rainfall intensities (e.g. the annual 1 hour and 24 hour duration rainfall volumes) that exceed an annual event threshold. Rainfall intensities are used as a proxy indicator for flood events because it is not possible to monitor all the regions rivers while there is only limited historical data on those that are monitored.

Between 2004 and 2008, 21 flow events exceeded the mean annual flood discharge on rivers that the ARC monitors. However, these events were too small to breach the channel banks and flood the neighbouring land. Rainfall data over the same period showed that Auckland's urban area experienced the greatest annual hourly rainfall events in region. Recorded high rainfall intensity events occurred:

- → On 2 February 2004, 49mm was recorded in one hour in Pakuranga (a one in 43 year return event).
- → On 1 October 2006, 36mm was recorded in one hour at Onehunga (a one in 20 year return event) and 129mm of rain fell near Waimaukau over a 24 hour period (a one in 83 year return event). The latter was the highest rainfall intensity event recorded in a rural area.

'Quick' flood peaks (the highest water level attained during a flood) can be experienced in the region's urban areas as a result of its relatively short waterways, large expanses of impervious surfaces that do not allow rainwater to soak into the ground, and extensive stormwater networks that channel excess water into the waterways (see Wastewater and stormwater in Chapter 3: Pressures, pg 61).

Hydrology monitoring programme

River levels and flow at 44 sites and rainfall at 40 sites are currently monitored by the ARC. The council also has access to river level and flow data at monitoring sites operated by NIWA, giving an overall total of 48 sites. This allows the ARC to determine whether rivers are approaching flood levels and to provide appropriate warnings to civil defence and emergency management agencies.

Rainfall intensity maps can provide flood hazard information by highlighting areas that are potentially vulnerable to flooding and where river flow is not monitored. In the Auckland region this information is important because there are many small rivers that cannot be monitored directly, and the large amount of impermeable surfaces in the urban area can result in a sudden influx of water from heavy rainfall entering the stormwater networks and rivers.

Indicator 4: Number and impact of floods

Between 2004 and 2008, 21 flow events exceeded the mean annual flood discharge on monitored rivers. However, the flow events that were recorded were, on most occasions, too small to breach the channel banks and flood neighbouring land. Recent flood damage has been poorly reported or is held as confidential by the insurance industry so it is difficult to determine the true impact on the Auckland region.

Storm events in 2007 and 2008 caused widespread damage across northern New Zealand and also impacted the Auckland region. No lives were lost but damage claims from surface flooding in the Auckland region totalled about $2 million. This figure does not include costs incurred through the loss of productive agricultural land and disruption to people's economic activities.

Droughts

An area is considered to be in drought when there is a scarcity of rainfall over an extended period of time. The Auckland region can experience two types of drought, an agricultural drought which is measured by the deviation below the normal soil moisture deficit or an hydrological drought which is measured by a lack of precipitation or river flow (e.g. a low flow event).

Drought monitoring programme

The hydrology monitoring network described previously can also detect hydrological droughts in the Auckland region.

Indicator 5: Number and impact of droughts

Two droughts occurred in early 2003. A one in 41 year low flow event lasting 135 days was recorded at Waitangi, south of the Manukau Harbour. Over the same period, a one in 25 year low flow event lasting 123 days was recorded at Waimaukau. These low flow events were significant because both occurred in areas that have a high dependency on water for agricultural and horticultural activities as well as for domestic use.

Natural hazards

The impacts of recent droughts have been poorly reported so it is difficult to determine the real effects on the Auckland region. Anecdotal evidence suggests that the impacts were felt amongst agricultural sectors, with loss of income and psychological stress occurring in southern areas during the 2003 events.

Auckland's urban area was considered relatively drought-free between 2004 and 2008 as monitored river levels did not fall below the Mean Annual Low Flow level. The urban area is supplied by Watercare Services Ltd, which reports sufficient storage capacity to withstand a 1 in 200 year drought.

Tornados

Tornados have potential to cause great damage and occur regularly in the Auckland region. However, their size limits their impact as events occur for short durations and cause extremely localised damage paths created by tornados are usually between 10m to 30m wide and 1 to 5km long.

Indicator 6: Number and impact of tornadoes

Since 2004, one or two tornados have occurred in the Auckland region each year while seven have made landfall. Approximately 40 homes experienced varying degrees of structural damage (particularly roofing) from these events. The cost of the damage resulting from all of the tornado events did not exceed $200,000 in insurance claims.

Landslides

Landslides are common on steep slopes in the Auckland region, particularly during prolonged and/or heavy rainfall. When rainfall is absorbed by soil, the cohesiveness of the soil may be decreased sufficiently to result in a landslide.

Indicator 7: Number and impact of landslides

In 2008 the Auckland region experienced very wet winter months, with 150 per cent more rain than the average. The rainfall, though moderate in intensity, was prolonged and kept the soil saturated. This increased the susceptibility of slopes to landslides during short periods of higher intensity rainfall. Between June and August 2008, 69 landslides were reported and it is likely that hundreds more were unreported. Major landslides were reported at Torbay, Kawakawa Bay, Glenfield, Swanson and Little Huia. Most landslides occurred towards the end of several episodes of heavy rainfall, during which about 50mm to 120mm of rain fell over periods of five to 10 days.

Landslides in urban areas threatened development on steep slopes with 50 people evacuated from 21 houses in North Shore City and Waitakere City during July and August 2008. A summary of reported damaging landslides that occurred during this period is given below:

- At Torbay, 65mm of rainfall over 48 hours triggered movement of a deep-seated landslide on 29 and 30 July. Monitoring after the event showed maximum vertical movements within the landslide of 700mm over 24 hours, indicating that movement was continuing. This prompted the evacuation of 14 houses in immediate danger and drainage of the landslide to stop further movement. Most of the residents returned home following a preliminary site inspection although one house was condemned and demolished, equating to over $400,000 in property loss. Later site investigations indicated that the landslide was an older feature which had been reactivated by rainfall. Recent development above the landslide may have increased the soil moisture level in the landslide body, which promoted its failure.
- At Kawakawa Bay and Little Huia, old deep-seated landslides were reactivated and resulted in property damage. In both cases a large amount of weathered soil overlying impermeable bedrock became saturated by persistent rainfall during June and July and started moving down slope during periods of heavier rainfall in August. The 1500 residents of Kawakawa Bay were isolated for four weeks by landslides at Turei Hill that closed the Clevedon-Kawakawa Bay Road (see case study Turei Hill, Kawakawa Bay, Manukau City (2008).
- At Swanson and Glenfield, a number of new landslide events were generated. In July, deep-seated landslides were large enough to threaten properties while the velocity of their movement down slope caused the evacuation of four and two houses respectively. Slope instability issues continued at the Glenfield site for another six months resulting in two homes being condemned equating to property losses exceeding $800,000, pending the resolution of litigation issues between the residents and North Shore City Council.
- At Little Huia, a landslide created significant ground deformation on surrounding properties with tension cracks and scarps up to 1m high forming across the landslide. Tension cracks occurred under building structures as the landslide moved although this ceased after emergency drainage was installed to stabilise the slope.

Numerous small, shallow landslides were also reported along major highways and arterial routes where slopes have been cut for roading. Although all the landslides reported during 2008 were triggered by rainfall, it is important to note that landscape modification was a likely factor leading to landslide events in urban areas.

Extensive remedial work was undertaken to clean up, repair and stabilise slopes across the Auckland region following the 2008 landslides.

In rural areas:

- large-scale earthworks began at Kawakawa Bay to drain and stabilise the landslide.
- slopes that failed in June and July in a number of locations along State Highway 1 in Rodney District required immediate clean-up to allow traffic movement.
- $140,000 of stabilisation work was performed along Scenic Drive, Titirangi in 2009 to remedy damage from a landslide in July 2008.

In urban areas:

- $200,000 was spent to repair a damaged section of road at Mulberry Place, Glenfield.
- an unstable cliff above the Parnell Baths, Parnell was deemed unsafe and required about $270,000 of repair works to lower the risk to bathers from future rock falls.

5.1

Natural hazards

- a landslide at Redoubt Road in Manukau City destroyed 100m of a water supply pipeline, cutting water to 3000 houses, and required remedial work that included slope grading and earth removal.
- houses affected by the Glenfield landslide required between $285,000 and $370,000 of engineering works to stabilise the site.

The landslide events of 2008 were not part of a catastrophic natural hazard event. However, the cumulative costs borne by Auckland communities from the resultant property damage, lost economic productivity, remedial work and clean-up costs exceeded millions of dollars while the extensive disruption caused to evacuees through relocation, time off work and theft was immeasurable.

Coastal hazards

Coastal erosion

The erosion of beaches and cliffs is an ongoing issue for the Auckland region. Erosion is a natural process operating on the region's beaches and rocky coastline as landforms respond to changes in wave energy, sediment supply, sea level (e.g. tides) and climate. The process becomes a hazard when development is located near an eroding coastline and is subsequently threatened or damaged.

Beach erosion

The susceptibility of the Auckland regions beaches to erosion broadly depends on their exposure to wave energy. Beach erosion modelling based on historic erosion rates and sea level rise scenarios suggests that beaches on the west and north-east coasts are likely to experience the largest amount of landward retreat from their present foredune toe or vegetation line.

Assuming that sea level will rise around the region by 500mm by 2100, it is predicted that west coast beaches are predicted to retreat by 46m to 54m over the next century. On the north-east coast, the spits at Omaha and Mangawhai-Pakiri are predicted to retreat 55m and 48m respectively. Sheltered beaches bordering the Manukau Harbour and inner Waitemata Harbour are expected to retreat 7m while those along the East Coast Bays beaches are predicted to retreat between 8m and 15m. North-facing beaches on Waiheke Island are expected to experience retreat rates of between 24m and 34m, similar to other exposed beaches.

All of these landward retreat rates are future predictions that show how the present state of beach erosion may vary over the next century. However, the actual retreat rates experienced will be controlled by many natural factors (e.g. changes in wave climate, sediment supply) as well as human activities such as sand extraction and shoreline modification.

Beach erosion monitoring programme

The ARC's beach profile monitoring programme records long-term changes in the shape of 16 beaches around the Auckland region and helps the council to understand how much sand is being transported onshore and offshore. The monitoring record ranges between 10 and 30 years.

All beaches that are monitored display variability, with phases of erosion and accretion. The degree of variability appears to be linked with local wave exposure. The west coast beaches of Muriwai and Piha show the greatest fluctuations in sand volume in response to high energy waves driven by the prevailing westerly winds. North-east coast beaches at Mangawhai, Te Arai, Pakiri and Omaha are exposed to moderate energy waves and can experience large variations in sand volume and beach width, primarily in response to north-easterly storms that cause erosion. In contrast, sheltered sites in the inner Hauraki Gulf (e.g. Kawakawa Bay, Maraetai and Orere Point) show the smallest variations. Changes in sand volume and beach width along the east coast bays are not as pronounced as north-east beaches but are greater than sheltered beaches.

Indicator 8: Amount and impact of beach erosion

Since 2004, beaches around the Auckland region have remained in a stable state despite short-term fluctuations in sand volume and beach width. Over the same period there has been no significant erosion damage to any developments located opposite beaches. However, the construction of new protection measures to slow any potential coastal erosion did result in significant costs over this period. For example, restoration of the sheltered beach at Kohimarama in 2006 cost $6 million, although the enhanced amenity value and improved infrastructure protection made this feasible.

Erosion on beaches that are exposed to higher levels of wave energy (such as those on the west coast) are treated differently, as engineering solutions often do more harm than good or are not feasible due to cost. In 2008, the decision was made to relocate the Muriwai Surf Club since the alternative, a protective seawall, would increase erosion along the beach.

Cliff erosion

Cliff erosion is not monitored consistently in the Auckland region but a recent review provided some estimates on the potential rates of cliff erosion over the next century (up to 2100). The predicted erosion rates were based on the modelling of historical erosion rates, geological conditions and predicted future sea level rise.

The geology (rock type and structure) of coastal cliffs is an important factor in determining their ability to resist erosion and this is reflected by the predicted rates for cliff erosion around the Auckland region over the next century, as shown in Figure 2.

The predicted erosion rates vary from zero for cliffs within the Hauraki Gulf composed of hard basalt to 347m in the soft alluvium cliffs along the exposed west coast of the Awhitu Peninsula. Much of the east coast within the Auckland urban area is bordered by cliffs composed of alternating beds of sandstone and siltstone. At present, these cliffs retreat at an average rate of 0.2m to 10m every century. These rates are most likely to represent episodic erosion events as the brittle nature and alternating sequence of rock types makes them susceptible to landslides. Over the next century, sandstone and siltstone cliffs are predicted to retreat between zero and 59m, potentially threatening a large number of coastal properties. Similarly, the greywacke cliffs bordering Waiheke Island and Maraetai are expected to retreat between 6m and 54m, which may threaten the stability of some cliff top buildings.

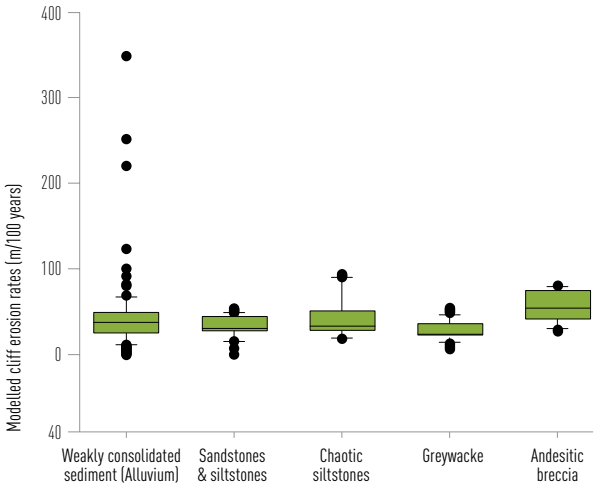

FIGURE 2 Range of modelled erosion rates for cliffs of different rock types around the Auckland region. (Source: ARC).

Indicator 9: Amount and impact of cliff erosion

Coastal cliff erosion has caused considerable impacts on Auckland properties in recent times. Within the last five years two highly publicised cliff failure events occurred: one at Little Shoal Bay in 2003 and the other at Bucklands Beach in 2008. 10m to 15m of cliff erosion occurred at both sites resulting in damage (or the threat of) to adjacent buildings.

At Little Shoal Bay, a property worth $1 million was decommissioned after heavy rainfall triggered a cliff failure. Remedial work could not be undertaken to save the house due to the size of the landslide.

In 2008, a cliff at Clovelly Road in Manukau City was destabilised during heavy rainfall, causing the evacuation of six properties. The loss of land and property totalled $1.5 million with further costs incurred by the property owners from site investigations and remedial work that was required to stabilise the cliff face.

The east coast of the Auckland region may continue to experience property loss and/or damage due to dense urban development on the top of actively eroding coastal cliffs.

Coastal flooding

High tides, storm events and large waves can combine to temporarily raise the sea level at the coast, causing flooding of low-lying coastal land. Around the Auckland region, the likelihood of coastal flooding is dependant on several factors that include the elevation of sea level (this can vary due to atmospheric pressure and the season), elevation of the coastline and the distance inland that waves run up.

Coastal flooding levels were modelled for the east coast of Rodney District in 2005 and for North Shore City in 2008, based on a 'worst case' scenario with a 1 per cent annual chance of occurrence (Figure 4). The amount of coastal flooding was calculated for present-day, 2050 and 2100 sea level to demonstrate how risk could increase in response to a future rise in sea level. The results suggest that coastal flood levels may rise 3m to 5.9m above Mean Sea Level (MSL) in Rodney District and between 3.1m and 4.6m along North Shore city. Variations in flood levels along these coastlines are the result of local variations in the type of shoreline, amount of exposure to waves and the tidal heights.

5.1

Natural hazards

Higher coastal flood levels, possibly more than 4m above MSL, are more likely to occur on shorelines that are exposed to high wave energy, such as those along the outer Hauraki Gulf or coastal sites that are armoured with coastal protection structures such as Gulf Harbour (this site has a potential to be inundated to 5.9m above MSL).

At Browns Bay on the North Shore, the modelled coastal flood level of 4m above MSL corresponds reasonably well with the approximate level of 3.5m above MSL that was recorded during the 1936 storm (this storm produced the region's worst coastal flooding in the last 100 years).

Indicator 10: Number and impact of coastal flood events

No significant coastal flood events were reported between 2004 and 2008, although minor incidents are known to have occurred along the east coasts of the Rodney and Franklin districts during storms in the winter of 2007 and September 2008.

Tsunami

A tsunami is a series of waves that form when an underwater earthquake, landslide or volcanic eruption displaces the seawater. In deep water, these waves are almost unnoticeable, but as they approach more shallow water near the coast they slow down and water piles up vertically to create extremely high and powerful waves. Some tsunami waves can be tens of metres high when they break onshore.

Historic and geological records indicate that the east coast of the Auckland region is most at risk from tsunami events in the long-term. The east coast is exposed to a number of areas around the Pacific Rim that can potentially generate tsunami waves. These areas can be classified as distant, regional and local sources.

Distant sources are located around the outer Pacific Rim where the Pacific plate boundary collides with various other tectonic plates. Historical records show that the distant tsunamis most likely to impact the Auckland region are generated off the Chilean coast. The largest historical event from this distant source occurred in 1960, when an earthquake produced a tsunami with estimated wave run-up heights above MSL of 2.9m on Great Barrier Island and 1.5m at East Tamaki.

Regional and local sources of tsunami waves often produce wave heights that are, locally, much larger than those from distant sources. Historically, the Kermadec Island area is the most frequent source of tsunami waves although these have tended to be small with an average wave height of 100mm above MSL.

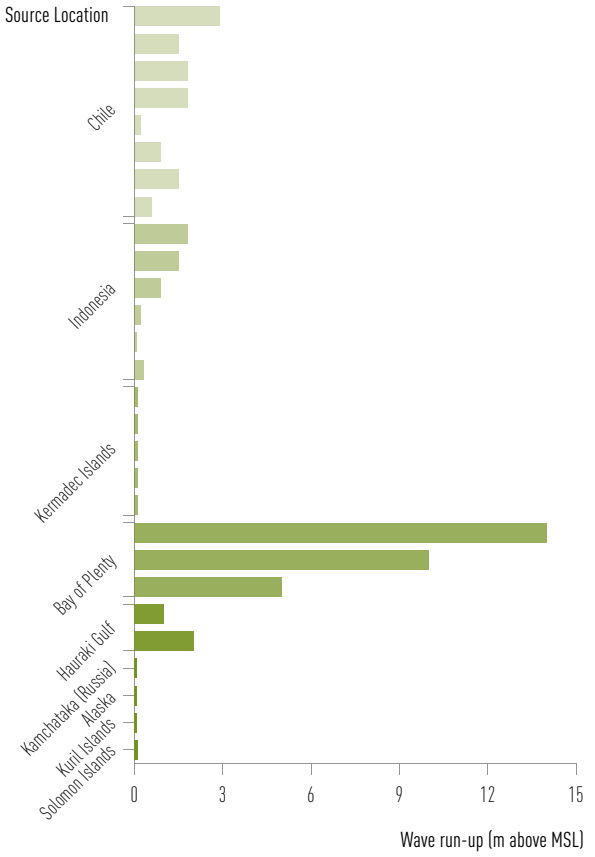

FIGURE 3 Source locations and tsunami wave run-up heights for historic and prehistoric tsunami events that have impacted the Auckland region. (Source: ARC).

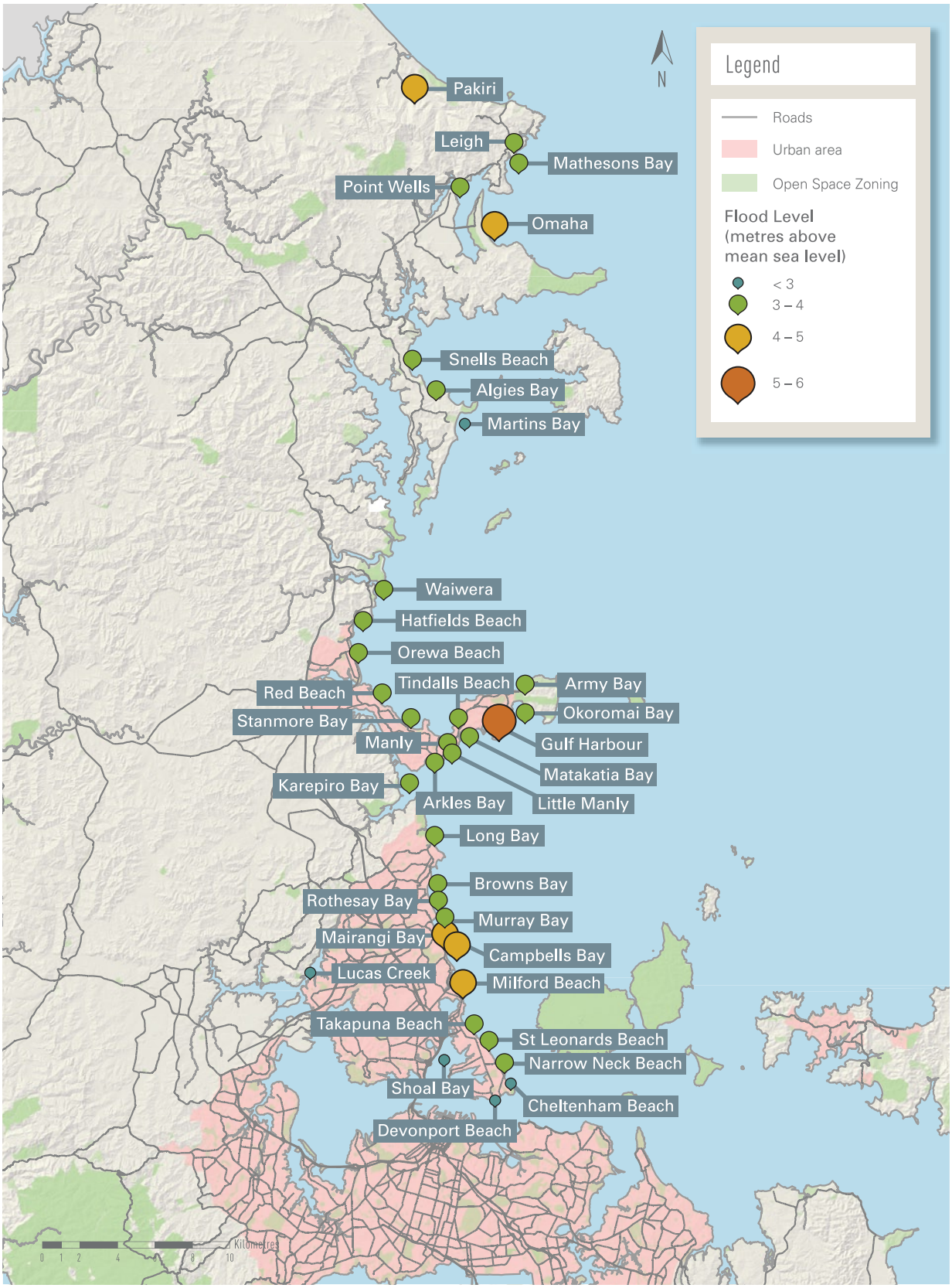

FIGURE 4 Predicted height of coastal flooding along the east coast of Rodney District and North Shore City, 2005. (Source: Tonkin and Taylor).

5.1

Natural hazards

Geological records indicate that considerably larger tsunami events have occurred in the past, possibly generated off the Bay of Plenty. Three events with estimated wave run-up heights between 5m and 14m are thought to have occurred within the last 2600 years (a return period of once every 870 years) although tsunami waves of this magnitude have not occurred in recent times. A similar event in the future will pose an extreme hazard to low-lying land on the east coast of the Auckland region, as tsunami waves from regional and local sources can arrive within one to three hours, giving people and the emergency services little time to respond.

The potential consequences for various tsunami scenarios has been modelled by GNS Science (Table 2).

Scenario modelling does have limitations when attempting to predict an outcome from infrequent events, but the GNS Science study provides an insight into how a tsunami event could impact the Auckland region. A one in 500 year tsunami event generated off the Chilean coast is likely to result in wave heights of 1.7m to 3.6m in the Auckland region, with larger waves affecting eastern coastlines. These waves would have a 50 per cent chance of causing about $2.16 billion in damage to buildings along with 120 deaths and 1230 injuries across east coast cities. In reality, deaths and injuries would be less for a tsunami originating off the Chilean coast as there would be a 12 hour to 15 hour warning time for coastal evacuation.

TABLE 2 Possible shoreline wave heights, building damage costs, deaths and injuries in urban areas in the Auckland region resulting from tsunami. (Source: Adapted from GNS Science).

City/ District	Wave height at shoreline (m)	Cost ($m)	Deaths	Injuries
Auckland (East)	3.6	1300	36	400
Auckland (West)	1.7	0	0	0
Manukau (East)	3.4	300	34	340
Manukau (West)	1.7	0	0	7
North Shore	3.5	430	28	300
Waitakere (East)	3.5	130	22	190
Waitakere (West)	1.7	34	2	33

The values shown in Table 2 will increase for regionally sourced tsunami events that could reach Auckland within one to three hours and create wave heights greater than 5m on the east coast.

Tsunami monitoring programme

Tsunami are measured from tidal gauges located on both the east and west coasts of the Auckland region. The tidal gauges are administered by external organisations (NIWA, Land Information New Zealand (LINZ) and the Ports of Auckland). The ARC has access to the tidal records.

Indicator 11: Number and impact of tsunami

Two tsunami events were detected by the tidal gauges in the Auckland region between 2004 and 2008:

- On 26 December 2004, an earthquake generated tsunami in the Indian Ocean was recorded on tidal gauges in the Kaipara, Manukau and Waitemata harbours. This tsunami originated 9,000km north-west of the Auckland region, therefore only small rises in the coastal water levels were noticed around the region. On the west coast, the tsunami wave varied between 0.22m and 0.31m and this decreased to 0.08m on the east coast as the tsunami wave was refracted around New Zealand. The west coast was closest to the tsunami generation area and therefore experienced the greatest tsunami wave height.
- Similarly, a 0.11m tsunami wave near the Solomon Islands on 1 April 2007 was recorded at Anawhata.

State of preparation for natural hazard events

The vulnerability of people, property and businesses to the impacts of natural hazard events depends not only on the likelihood of an event but also on people's preparedness to respond effectively and lessen the impact.

Advance preparation by individual households can limit vulnerability to harm both during and after a natural hazard event. Advanced preparation by businesses, and infrastructure that is engineered to withstand the impacts of natural hazard events, serve to reduce the level of social, physical and economic disruption to human populations and speed the return to normal conditions.

Household preparation

The relative infrequency of some types of natural hazard event in the Auckland region and a lack of firsthand experience of their consequences often makes it difficult to effectively communicate the importance of preparation. A 2008 survey found that people in the Auckland region are less prepared for natural hazard events than those in the rest of New Zealand, with 59 per cent admitting that they are not well prepared – or are not at all prepared – for a disaster, compared to the national average of 45 per cent.

Natural hazards

Knowledge of natural hazards is relatively poor, with a quarter of all the people in the region and almost half of non-Māori or New Zealand European ethnic groups unaware of the types of natural hazards that threaten the area. In addition:

- only 35 per cent of Auckland households have an emergency survival plan, compared to the national average of 50 per cent.
- only 32 per cent of Auckland households have sufficient water for each occupant for three days, compared to the national average of 46 per cent.
- only 67 per cent of Auckland households have emergency survival items, compared to the national average of 79 per cent.

This lack of knowledge or desire to participate in disaster planning is of concern, as it means there is a poor level of preparation amongst households in the Auckland region.

Emergency survival plans, sufficient water and emergency survival items can be used for all types of natural hazard events. A significant number of Auckland households need to improve their level of preparation for natural hazard events if their occupants want to lessen their vulnerability, protect themselves and ease their dependency on emergency services.

Business preparation

There is currently a lack of knowledge about the amount of advance preparation and disaster planning done by businesses in the Auckland region.

Insurance

Insurance plays an important role in creating communities that are resilient to natural hazards. Individuals and businesses that insure against natural hazards can reduce their economic losses substantially, as insurance can prevent or reduce the need to pay for damage, home and business displacement or relocation. It can also cover income and productivity losses during the recovery period following an event. Information on the total percentage of Auckland households and businesses insured against natural hazards is sensitive, but all households are covered by the Earthquake Commission (EQC) for damage caused by earthquake, landslide, tsunami, volcanic eruption, storm and flood (residential land only) and hydrothermal activity. If a house is impacted by these events, the EQC will pay up to $120,000 for damage to property and possessions, with insurance companies covering any remaining damage that is insured. The ARC encourage households and businesses that may be located in hazardous areas to insure themselves against natural hazard events.

Conclusions on natural hazards

The Auckland region was impacted by a variety of natural hazard events between 2004 and 2008. The majority of events were triggered by climatic hazards with flooding, landslides (including coastal cliff instability) and tornados experienced by a number of communities. These events had localised impacts that often resulted in property damage, infrastructure failure and/or disruption to normal life.

Climatic hazard events caused the most damage, with a spate of floods and landslides during the winter of 2008 affecting thousands of people and causing millions of dollars in property damage, clean-up and remedial works. Other associated (but immeasurable) costs to affected individuals and communities resulted from disruption to daily routines and loss of livelihood. On an individual basis, the climate-induced hazard events that affected the Auckland region were not catastrophic though their cumulative impact was regionally significant. Future climate change could potentially increase the frequency and intensity of heavy rainfall events leading to more flooding and landslides (see Climate change in Part 1).

Geological hazards had a minimal impact on the Auckland region when compared to climatic hazards. Although these types of natural hazard are known to threaten the Auckland region, they occur far less frequently than climatic hazards. Nevertheless, it remains important to assess the consequences that geological hazard events may have on communities in the Auckland region. For example, a volcanic eruption in the Auckland region could have a significant impact on businesses, particularly in terms of job losses, and result in a substantial decline in both regional and national GDP. However, the depth of the resulting economic downturn could be reduced somewhat by suitable advance preparation by regional businesses.

Up-to-date regional information on natural hazards and their impacts is vital to enable the ARC to implement risk reduction mechanisms in the best and most effective way. Our involvement in planning, civil defence emergency management and education also helps to reduce the risks that natural hazard events pose to Auckland communities. However, our involvement is only a part of creating communities that are prepared to deal effectively with natural hazard events because, ultimately, individuals need to take ownership of their risk. A significant number of Auckland households need to improve their levels of natural hazard awareness and preparation.

5.1

Natural hazards

ARC responses

Natural hazard management and planning

Preservation of human life is the most important aspect of natural hazard management and planning. The ARC currently plays a leading role in co-ordinating natural hazard management across the Auckland region. Natural hazard management is undertaken through various regulatory and non-regulatory actions that involve a number of groups from local authorities, central government, infrastructural organisations, emergency services, crown research institutes, universities and the public.

The Auckland Regional Policy Statement (ARPS) identifies natural hazards in the Auckland region, and was amended in 2005 to clarify roles and responsibilities in natural hazard management. These amendments also covered a wider range of natural hazards and hazard management responses, as required by new or amended legislation including the Civil Defence Emergency Management Act (2002), the Building Act (2004) and the Resource Management (Energy and Climate Change) Amendment Act (2004).

The ARPS includes policies and methods that try to direct development and land use activities to avoid or lessen the impacts of natural hazards. Further provisions provide local authorities with the means to undertake non-regulatory measures to try and lessen the potential impacts of natural hazard events that occur only occasionally in the Auckland region (such as volcanic eruptions and earthquakes).

The Auckland Regional Plan: Coastal contains policies and methods that relate to natural coastal hazards (particularly coastal erosion and flooding). It promotes the avoidance of natural hazard events and the reduction of risk from coastal erosion, and contains criteria and rules for coastal hazard protection works.

The Proposed Auckland Regional Plan: Air, Land and Water contains policies and rules to address stormwater runoff and flooding. The rules cover discharges to land and water, the building of structures, works in riverbeds and land drainage activities, and aim to avoid or minimise the likelihood of creating a stormwater or flood hazard. The plan emphasises the need to undertake land use activities in such a manner that flooding of adjacent land or the exacerbation of existing flooding problems are avoided.

The Auckland Regional Plan: Sediment Control deals with soil erosion issues, particularly for land development or redevelopment activities that involve vegetation clearance and/or earthworks. Emphasis is placed on the sediment and erosion control initiatives.

Natural hazard risk assessment

Natural hazard risk assessment for the Auckland region is currently carried out by the ARC, local councils (either independently or in partnership with the ARC), GNS Science, NIWA and some universities, particularly the University of Auckland. The likely impacts of natural hazard events on communities are identified from recent events and also from scenario modelling based on historical events.

Information generated by these organisations is used to improve our understanding of natural hazards and the risks that they pose to the Auckland region. This provides a basis for developing the policies and rules in regional, district and city plans, in catchment management plans, public education policies, emergency management planning and exercises, and infrastructural development.

Research into natural hazards and the likely impact of events is vital to reduce the level of risk to people throughout the Auckland region. For example, by providing a snapshot of the consequences that people in the Auckland region could face from events they have not yet experienced.

Working with the community

The ARC currently works with other councils and organisations to improve public awareness of natural hazards, and to limit the potential impacts of natural hazard events on communities throughout the Auckland region:

- **Information provision.** Provision of natural hazard information to the public through its website (and the Auckland Region Civil Defence Emergency Management Group website), group presentations, answering public enquiries, and online technical publications and fact sheets.
- **Civil Defence Emergency Management.** Assisting the Auckland Regional Civil Defence Emergency Management Group in public education and provide natural hazard information for emergency management planning and exercises.
- **Natural hazard prevention.** Provision of a range of courses and workshops to assist industries involved with land modification to limit erosion and flooding impacts. Auckland also has a number of Beachcare groups that are run by volunteers enabling local communities to take action on environmental issues affecting their coastlines. Support is provided to these groups including guidance on how to rejuvenate and maintain coastal systems (such as sand dunes) to improve both the environment and natural hazard management.
- **Lifelines Groups**. The Auckland Engineering Lifelines Group is a voluntary group of 'lifelines' organisations (e.g. gas, electricity, water, transport) with representation from councils including the ARC who assists with administration and research to help identify natural hazards and lessen their effects on the lifeline utilities.

Case Study: Turei Hill Landslide, Kawakawa Bay, Manukau City (2008)

On 24 August 2008, a prolonged period of rainfall triggered a 500m^3 landslide on Turei Hill closing the major access road to the coastal settlement of Kawakawa Bay and isolating residents.

Ground investigations following the landslide revealed it to be a part of an older 150,000m^3 to 250,000m^3 landslide that was sliding toward the Clevedon-Kawakawa Road and Kawakawa Bay houses (Figure 1).

FIGURE 1 Aerial view of the 24 August 2008 landslide that blocked the Clevedon-Kawakawa Bay Road. The larger landslide which threatened a house is indicated by the white dash line. (Source: Manukau City Council).

Monitoring the landslide's movement revealed that five homes and the Clevedon-Kawakawa Bay Road were in imminent danger from slope failure. The homes were evacuated and the road closed for four weeks until the slope movement ceased. During this time, 1,500 residents had to travel an extra 100km or walk over Turei Hill to get to work or school. The community's isolation also impacted local businesses. In the month following road closure, the Beachcomber Motel had one customer (a lost driver) while Kawakawa Bay Motors petrol sales dropped more than 50 per cent. The community's isolation and loss of business revenue demonstrates the indirect impacts of a landslide event.

Remedial works to stabilise the landslide began in September 2008, when the rain eased (Figure 2). To ease pressure on the slope toe 66,000m^3 of earth was removed from the upper slope after a decommissioned house was demolished.

The entire landslide was buttressed at the slope toe by 12.5m and 24.5m high retaining walls backfilled with 34,000m^3 of earth from the upper slope. A network of 35 drains was constructed to remove groundwater while 70 rock anchors (each 45m long) hold in place retaining walls and cut slopes. On completion of earthworks the slope will be revegetated to cover bare soil and improve visual amenity.

The large-scale remedial works to stabilise Turei Hill required nine months of seven day working weeks. Opus International Consultants indicated the cost of these works was about $5.3 million which was jointly funded by Manukau City Council, the New Zealand Transport Agency and the Earthquake Commission. This option was preferred over an alternative road into Kawakawa Bay and removal of five threatened houses at a cost of $13 million.

The 2008 Turei Hill landslide demonstrated how relatively common natural hazards can cause major disruption to communities in the Auckland region.

FIGURE 2 Aerial view of the earthworks being undertaken in May 2009 to stabilise the Turei Hill landslides. (Source: Manukau City Council).

5.1

Natural hazards

References and further reading

Berryman, K. R. (ed)., 2005. *Review of tsunami hazard and risk in New Zealand*. GNS Client Report 2005/104. Institute of Geological and Nuclear Sciences.

Magill, C. R., Hurst, A. W., Hunter, L. J., Blong, R. J., 2006. Probabilistic tephra fall simulation for the Auckland region, New Zealand. *Journal of Volcanology and Geothermal Research*. 153. 370-386.

Reinen-Hamill, R.; Hegan, B.; Shand, T. (2006). *Regional assessment of areas susceptible to coastal erosion*. Prepared by Tonkin and Taylor Ltd for Auckland Regional Council. Auckland Regional Council Technical Report 2009/009.

Tonkin and Taylor, 2005. *Assessment of potential sea levels due to storms and climate change along Rodney's east coast*. A technical report prepared for Rodney District Council.

Tonkin and Taylor, 2005. *North Shore City sea inundation study*. A technical report prepared for North Shore City Council.

5.1

Natural hazards

Photo: Vaughan Homestead, Long Bay Regional Park, Auckland. (Source: ARC).

5.2

Hazards and heritage – Historic heritage

Contents 5.2

5.2

Historic heritage

Introduction

The Auckland region has a rich and diverse land-based historic heritage. This encompasses all of the historic places and areas that are significant to us because they are associated with our ancestors, our cultures and our past, such as:

- archaeological sites
- historic buildings, places, objects and structures
- places of significance to Māori, including waahi tapu, urupā, and places of traditional importance
- trees or other plants with historical or cultural associations
- cemeteries and burial places
- shipwrecks and other maritime heritage
- landscapes and areas of historic or cultural significance
- places where significant events have occurred.

The ARC promotes the preservation and protection of historic heritage, which is under increasing pressure from development and cannot be replicated or replaced because it is a product of past human activity. The protection of historic heritage is a matter of national importance under the Resource Management Act (RMA).

Historic heritage is a non-renewable resource of limited supply. It is susceptible to physical changes that may reduce or negate the particular qualities that contribute to its value. For example, urban infill and redevelopment can result in more intensive use of built heritage (buildings and structures) and the loss of their surroundings, including botanical features such as trees. Retaining the heritage value of a building may be undervalued when compared to redevelopment of a site for maximum economic gain.

Population growth in the Auckland region (see Population growth and change in Part 2) has resulted in rural land being developed for residential and commercial use. As housing and related infrastructure (such as stormwater and sewerage systems) is developed, it places pressure on fragile and already diminished archaeological and Māori heritage areas. Coastal land is particularly popular for subdivision and development but often contains a high concentration of archaeological sites that are related to early Māori occupation and use, and to later European activities.

However, not all threats to heritage sites are from urban expansion. Natural processes such as coastal erosion are becoming an increasing threat (see Coastal erosion in Chapter 5.1). Heritage sites along the coastal margins are also at risk of damage or destruction due to storm events and sea level rise as a result of climate change.

Historic heritage monitoring programmes

The ARC currently runs a number of monitoring initiatives (such as the annual coastal survey and the archaeological site monitoring programme in regional parks) which identify and assess previously recorded and unrecorded heritage sites.

Data relating to the presence and nature of historic heritage sites in the Auckland region have been collected since 1997 and stored in the Cultural Heritage Inventory (CHI). It was developed by the ARC, and is currently maintained and supported by local councils and some government agencies such as the New Zealand Historic Places Trust (NZHPT) and the Department of Conservation (DOC), as well as heritage consultants.

The CHI holds data on:

- places that are formally recognised by the NZHPT Rarangi Taonga: the Register of Historic Places, historic areas, waahi tapu and waahi tapu areas.
- places that are scheduled for protection in the Auckland Regional Plan: Coastal and district plans that have been prepared under the RMA.
- archaeological sites recorded in the New Zealand Archaeological Association (NZAA) Site Record File.
- historic sites managed by DoC.

The location of known heritage items across the Auckland region is mapped. Many other heritage places and sites from various sources (including botanical items) have been added to the CHI database because of their heritage values and interest.

The CHI became web-based in mid-2009, giving councils full access to the data as well as the ability to download reports directly. In addition, the public have limited access to the CHI website, enabling anyone to easily contact our Cultural Heritage team for specialist advice and interpretation. Prior to this, information was sent annually to the councils of the region, iwi, DoC and the NZHPT, and was provided upon request.

Although the CHI is an important information source on known heritage items in the Auckland region it does have two limitations:

- the data are not based on a comprehensive survey of the Auckland region. At the end of 2008, it was estimated that only 29 per cent of the land within the Auckland region had been surveyed and assessed for heritage values.
- there is a lack of systematic monitoring of known, inventoried items. Although some territorial authorities have undertaken specific monitoring from time to time, there is no overall regional monitoring programme that provides information on the changing state of heritage items, or on the effectiveness of our responses.

Historic heritage

Although this lack of systematic monitoring limits our ability to report on the state of historic heritage in the Auckland region using the DPSIR framework (driving forces, pressures, state, impact responses), we have used the best information that is available from the CHI, and other sources, to provide an overview of our knowledge in the following sections.

The state of historic heritage

Heritage items recorded in the Cultural Heritage Inventory (CHI)

This indicator describes the overall number and types of heritage items recorded in the Auckland region. It is not a comprehensive stocktake because our knowledge is incomplete. The CHI does, however, provide the most comprehensive register of heritage items that is available. This information is a useful measure of our awareness of historic heritage across the Auckland region and whether or not this awareness is getting better, worse or not changing over time.

Indicator 1: Number and type of heritage items

At the end of 2008, approximately 15,745 heritage sites within the Auckland region were recorded in the CHI database. These consisted of:

- 10,416 archaeological sites
- 2,983 historic buildings and structures
- 963 sites with historic maritime associations
- 922 botanical heritage sites (trees and plants with historical or cultural associations)
- 28 Māori heritage areas
- 433 reported historic sites (places that are referred to in books or marked on maps).

The number of items recorded in the CHI has been increasing steadily over the past decade (Figure 1), driven predominantly by an increase in the number of archaeological sites.

A number of activities account for this growth in recorded heritage items over time. New sites have been identified by district and city councils that have undertaken heritage assessments as part of their district plan changes or reviews, for example, Auckland City Council initiated a number of plan changes to introduce new items to their district plan heritage schedules.

New sites are also identified through assessment processes, such as developing structure plans for new subdivisions, or while preparing resource consent applications.

The ARC is also notified of other sites by personal accounts, and these are recorded in the CHI if credible and reliable.

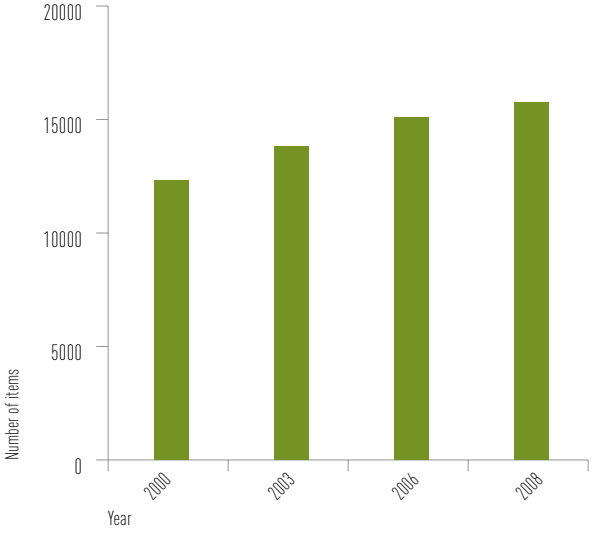

FIGURE 1 Number of items recorded in the Cultural Heritage Inventory 2000-08. (Source: ARC).

5.2

Historic heritage

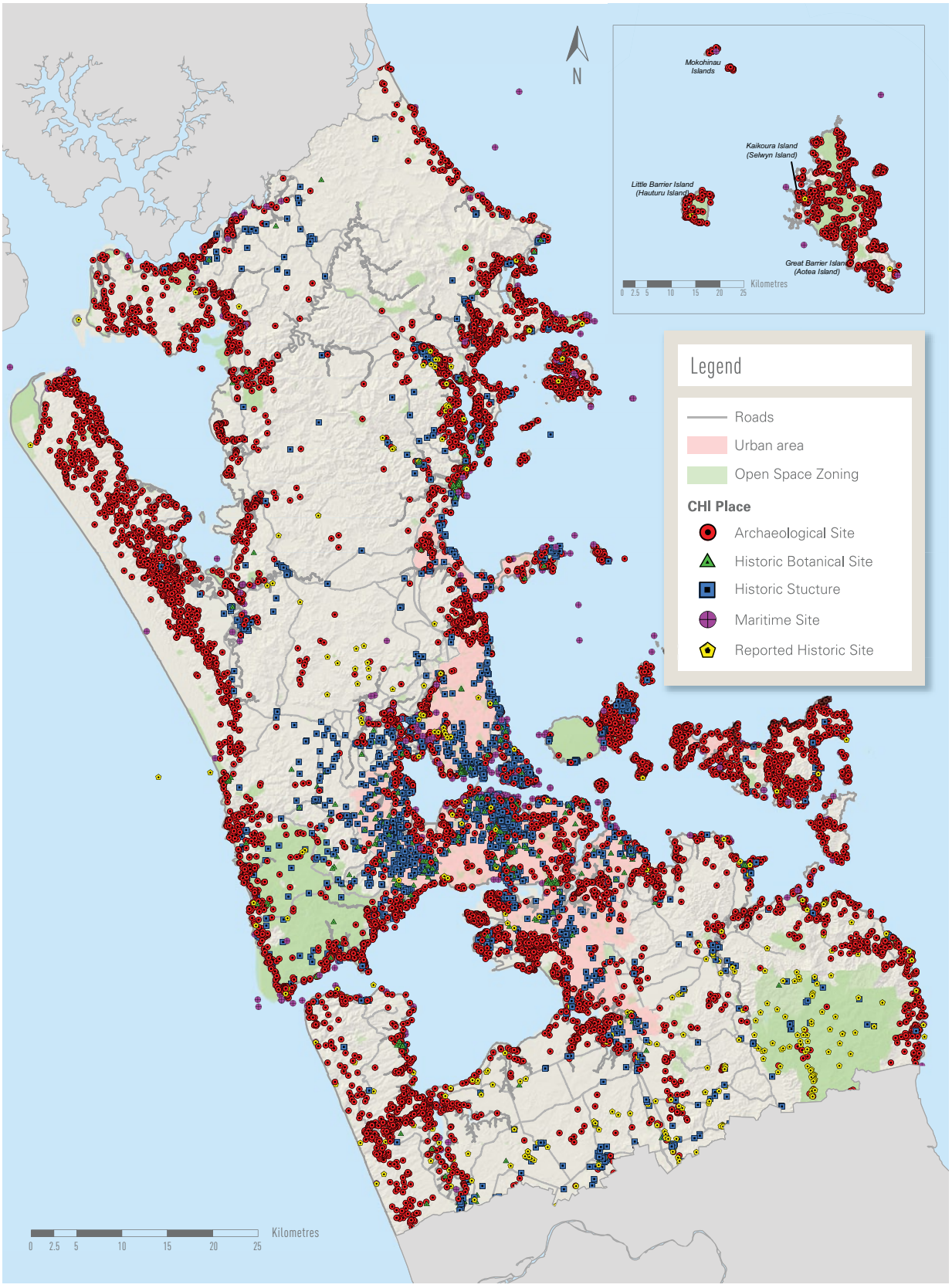

FIGURE 2 Distribution of heritage sites recorded in the Cultural Heritage Inventory. (Source: ARC CHI).

Indicator 2: Distribution of heritage sites

Figure 2 (over the page) shows the distribution of all the heritage sites throughout the Auckland region that are recorded in the CHI database.

Three patterns are evident:

- → A large number of sites are located along or adjacent to the coastline. Typically, these are archaeological sites associated with Māori occupation and/or use before European settlement. In addition, the coastal environment has been assessed as a high priority area for heritage surveys because it is known to have been a popular area for settlement by both Māori and early Europeans, and is currently in demand for coastal subdivision and development. Therefore, more effort has been spent on surveying, resulting in more comprehensive data for the coastline area compared to other locations.
- → There is a greater concentration of heritage sites in the more urbanised areas of Auckland City, Manukau City and North Shore City because these are high density urban areas with many buildings that are recognised for their heritage value. In addition, strong development pressure in these urban areas has led to the identification of new sites through the development control process. For example the requirement for resource consent applications to include a heritage assessment identifying the heritage values associated with a site that is earmarked for development).
- → There are large areas within the Auckland region that have no recorded heritage sites (e.g some rural areas in the north and south of the region). This does not necessarily signify an absence of heritage sites but rather a lack of systematic surveys to identify such sites.

Indicator 3: Amount of land surveyed for heritage sites

Over the past eight years there has been a slow but steady increase in the area of land that has been systematically surveyed and assessed for the presence of heritage sites. The CHI contains an extensive bibliography of published and unpublished reports and other documentation that provides detail about surveys and the land areas that they covered. This survey information relates almost exclusively to archaeological surveys, and is plotted using Geographic Information Systems (GIS) to mark the locations and boundaries of the surveyed land areas.

By 2000, only about 17 per cent (84,019 hectares) of the land in the Auckland region had been surveyed and assessed. However, at the end of 2008, this had increased to an estimated 29 per cent (148,100 hectares) of land (Figure 3 on page 280).

The purple zones indicate entire properties or areas that underwent a systematic heritage survey, with the results recorded in a detailed report. The lilac zones indicate areas that were subject to less systematic reports, meaning that the quality and extent of the information gathered is variable. Lilac zones represent older datasets and surveys that, in many instances, cover only limited parts of a property or area.

Resurveying in response to new developments or resource consent applications means that consultants, local council and/or ARC staff are revisiting many of these lilac zones to more accurately survey and assess the historic heritage located there.

Heritage items registered by the New Zealand Historic Places Trust (NZHPT).

Since 1980, the NZHPT has had a statutory role under the Historic Places Act (HPA) 1993 to identify important items of heritage value and include them on the NZHPT register. Consequently, places and areas that satisfy the registration criteria have been added to the NZHPT Rarangi Taonga: the Register of Historic Places, Historic Areas, waahi tapu and waahi tapu areas.

This register is an important source of information about the national historic heritage and is used by local authorities when preparing schedules for their district and regional plans (although not all registered items are added to the heritage schedules in the district or city plans).

Since 2004, the NZHPT register review process has been improving the quality of information held on earlier registrations, thereby improving overall knowledge of heritage items in the Auckland region. However, registration is an identification mechanism only. It does not offer any protection to heritage items, as the NZHPT relies on local authorities to include the registered items in their heritage schedules.

Indicator 4: Number and type of NZHPT registered items

Over the past four years, there has been a steady upwards trend in the number of NZHPT registered items in the Auckland region (Figure 4).

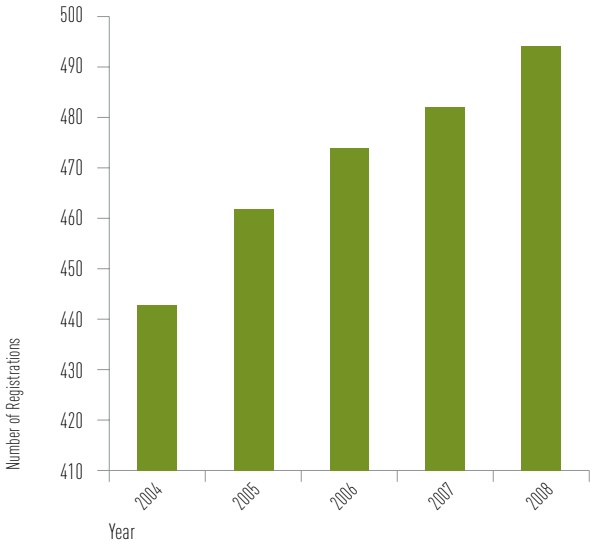

FIGURE 4 Number of NZHPT registrations for the Auckland region 2004-08. (Source: NZHPT register).

5.2

Historic heritage

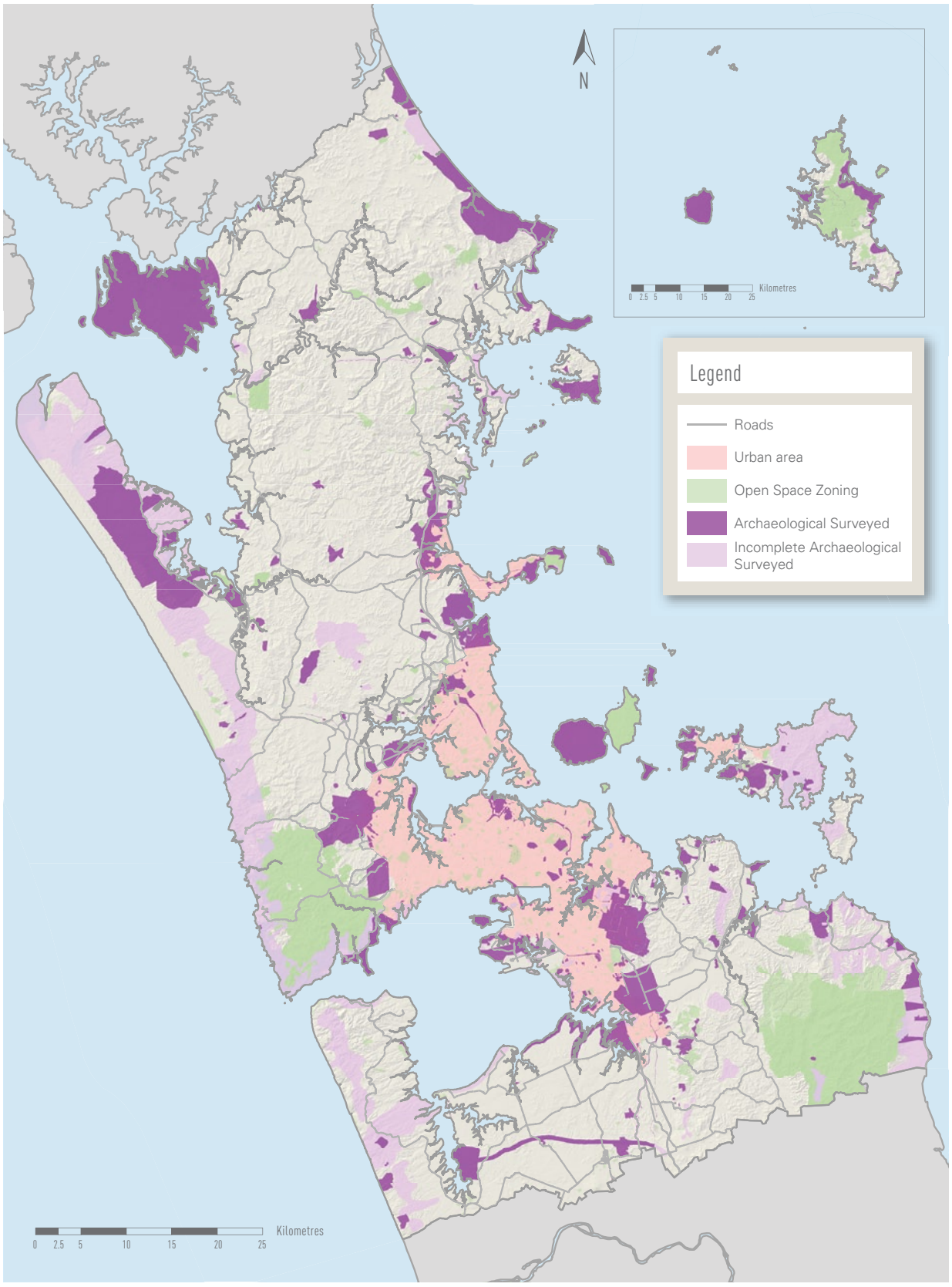

FIGURE 3 Amount and location of land areas surveyed for heritage sites. (Source: ARC CHI).

Historic heritage

Table 1 shows that there were 494 registered items in the Auckland region (about 9 per cent of the 5555 items that are registered nationally) at the end of 2008.

This represents an average annual increase of 2.5 per cent in the total number of registrations over this period.

TABLE 1 Total number and type of NZHPT registrations for the Auckland region in 2008. (Source: NZHPT register).

Council	Registration type and number				
	Historic place	Historic area	Waahi Tapu	Waahi Tapu area	Total
Auckland City	342	10	2	2	356
Franklin District	11	0	0	0	11
Manukau City	41	0	0	0	41
North Shore City	18	0	0	1	19
Papakura District	5	0	0	0	5
Rodney District	51	0	1	1	53
Waitakere City	9	0	0	0	9
Total	**477**	**10**	**3**	**4**	**494**

Historic places dominate the types of registrations approved by NZHPT. Figure 5 shows that 96 per cent (477) of all NZHPT registrations are historic places and the vast majority are buildings, structures (including wharves and stone walls) and objects such as memorials. In contrast, ten historic areas in Auckland City make up another 2 per cent of the NZHPT registered items, with three waahi tapu sites and four waahi tapu areas making up the remainder.

This demonstrates the dominance of built heritage on the NZHPT register and, in particular, the identification of individual built items. Recognition of Māori heritage, in the form of waahi tapu sites and waahi tapu areas, and the group value of heritage buildings, sites and places (provided for by historic area registration) are significantly under-represented.

In accordance with the Historic Places Act , historic places that are registered with the NZHPT are assigned a Category I or Category II rating, depending on their level of significance or value.

- → Category I applies to 'places of special or outstanding historical or cultural heritage significance or value'.
- → Category II applies to 'places of historical or cultural heritage significance or value'.

Figure 6 shows that the majority of NZHPT registered historic places in the Auckland region have Category II status and just over a quarter have Category I status.

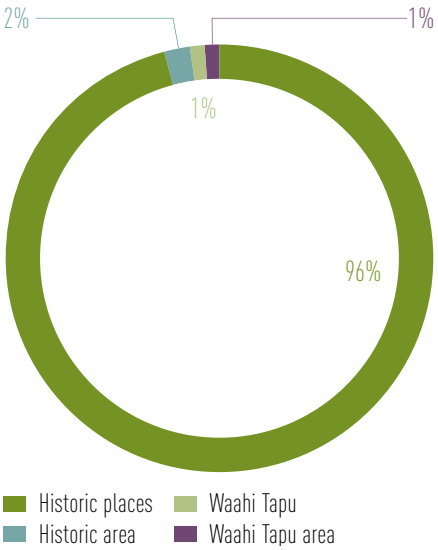

FIGURE 5 Type of NZHPT registrations. (Source: NZHPT).

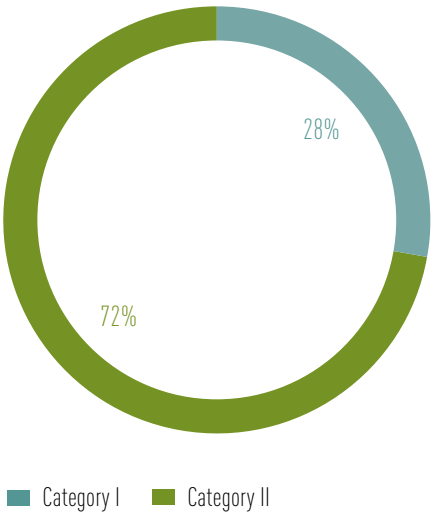

FIGURE 6 NZHPT registered historic places, by category. (Source: NZHPT).

5.2

Historic heritage

Indicator 5: Location of NZHPT registered items

A substantial number (356) of all the NZHPT registered items, equating to almost three-quarters (72 per cent), are located in Auckland City (Figure 7 and Figure 8). This is not surprising, as it is the largest city in the country with an extensive built environment.

However, this figure is disproportionately large when compared to Manukau City (the third largest city in the country) which has only 41 (8 per cent) registrations in the Auckland region and to North Shore City (the fourth largest city in the country) which has only 19 (4 per cent). Papakura and Franklin districts have only five and nine registered items respectively.

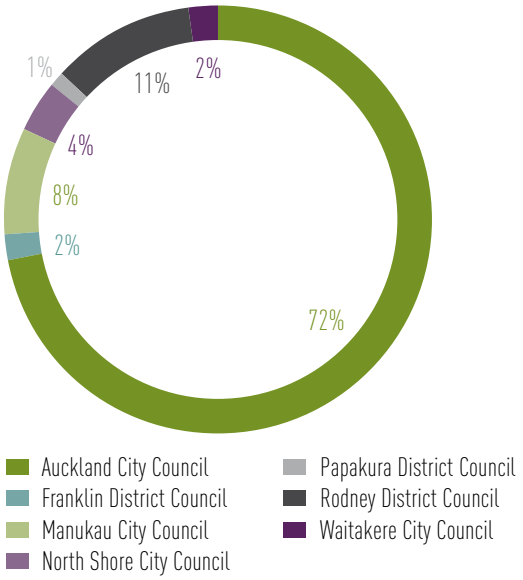

FIGURE 7 Proportion of NZHPT registered heritage items by council. (Source: NZHPT register).

Table 2 shows that most Category I historic places are found in Auckland City, with all other councils far behind in comparison. There are no Category I registrations in Papakura District. Auckland City also has the greatest proportion of Category I historic places (33 per cent) when compared to Category II registrations.

TABLE 2 NZHPT registered historic places, by category and council. (Source: NZHPT register).

Council	Category I	Category II	Proportion of Category I (%)
Auckland City Council	114	228	33
Franklin District Council	2	9	18
Manukau City Council	4	37	10
North Shore City Council	5	13	28
Papakura District Council	0	5	0
Rodney District Council	8	43	16
Waitakere City Council	1	8	11
Total	**134**	**343**	

The NZHPT approved 55 registrations in the Auckland region between 2004 and 2008 (Figure 8). Forty-six of these (84 per cent) are located in Auckland City (Figure 9). North Shore City had the next highest number of recent registrations (six) while Franklin District, Rodney District and Waitakere City each had one new registration approved. Manukau City and Papakura District have had no new registrations since 2004.

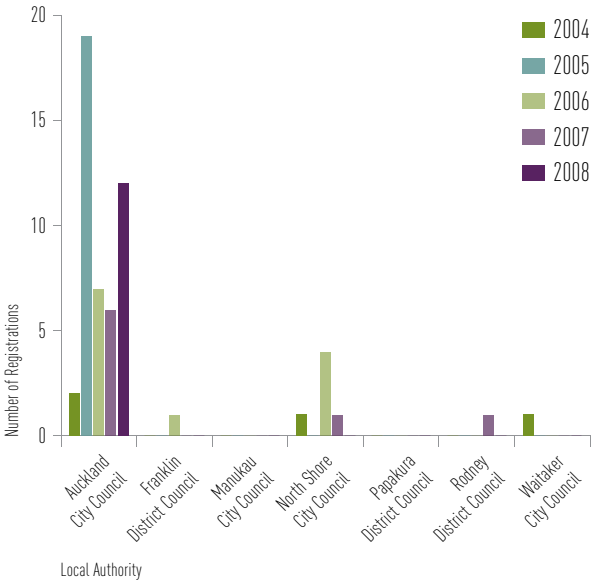

FIGURE 8 New registrations approved by the NZHPT 2004-08. (Source: NZHPT register).

This suggests that the NZHPT has been proactive in identifying historic heritage for registration in Auckland City, possibly due to a greater perceived level of threat from intense development pressure.

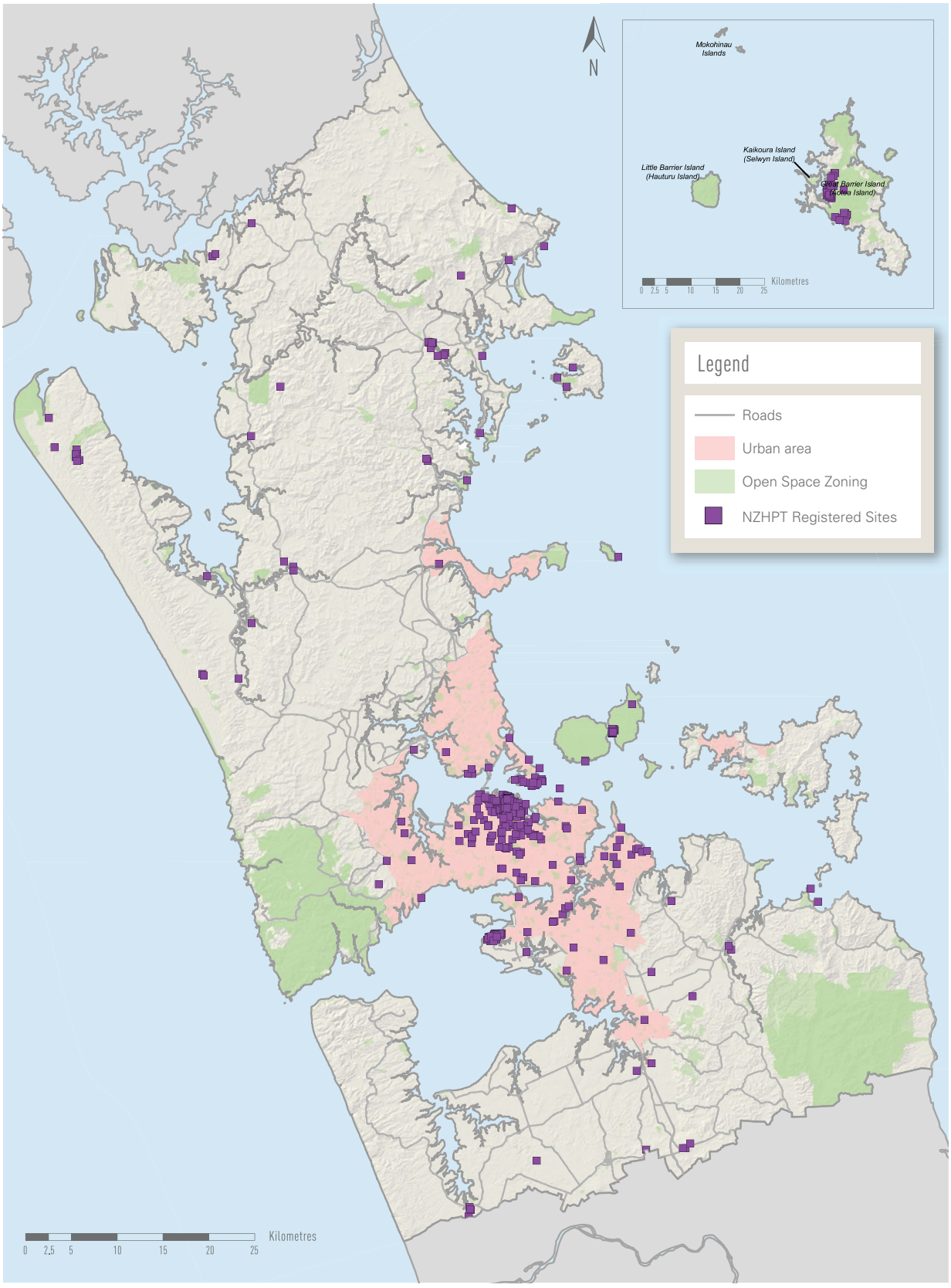

FIGURE 9 Location of NZHPT registered heritage items across the Auckland region. (Source: ARC CHI).

5.2

Historic heritage

Condition of and risk to heritage items

The ARC and other agencies in the region currently expend considerable effort and resources in trying to identify and protect heritage values. However there is little systematic monitoring of the condition of historic heritage.

The following indicators report on applications made to destroy or modify known built heritage sites. However, they do not report on any human-inflicted damage that may be occurring without appropriate consent, or sites that are not scheduled in plans or not registered by the NZHPT (where consent is not required). Neither do these indicators report on the extent of deterioration due to natural processes (e.g. exposure to wind, rain and sunlight).

Indicator 6: Number of resource consents for demolition or relocation

Data for this indicator was collected for 2005 and 2006. A national list of heritage items was compiled from the 11,633 items that were scheduled by council, district and regional plans, registered by NZHPT, or on conservation land managed by DoC. Archaeological sites were excluded from the list. Table 3 shows the number of built heritage items that were destroyed, relocated or partly removed as a result of resource consents granted by the relevant council during this period.

TABLE 3 Number of protected heritage items that were destroyed, relocated or partly removed in 2005/06. (Source: Opus International Consultants Ltd, unpublished findings).

Region	Destroyed	Relocated	Partly removed	Total
Northland	2	0	0	2
Auckland	3	0	0	3
Waikato	2	1	0	3
Bay of Plenty	0	0	0	0
Hawke's Bay	4	1	0	5
Wanganui	1	1	0	2
Wellington	3	3	1	7
Nelson/Marlborough	1	0	0	1
Canterbury	3	1	3	7
West Coast	1	0	0	1
Otago	4	3	2	9
Southland	0	0	0	0
Total	**24**	**10**	**6**	**40**

Historic heritage

Three protected built heritage items were destroyed in the Auckland region, all located in North Shore City and listed on the heritage schedule of the district plan (but not registered by the NZHPT).

Figure 10 shows that compared with the rest of the country, the results for the Auckland region are better than for a number of other regions (notably Otago, Wellington and Canterbury).

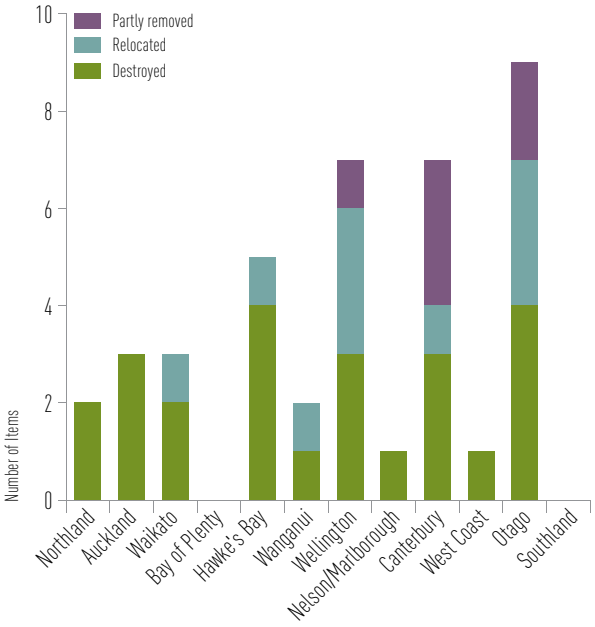

FIGURE 10 Number of protected heritage items destroyed, relocated or partly removed in 2005/06 by region. (Source: Opus International Consultants Ltd, unpublished findings).

Indicator 7: Number of authority applications granted

The NZHPT is responsible for granting authority applications to modify, damage or destroy an archaeological site (whether or not it is scheduled in a district plan). Between 2004 and 2008, the NZHPT made decisions on 200 authority applications in the Auckland region:

- → 186 were granted
- → one was part granted/part declined
- → one was declined
- → 12 were withdrawn by the applicants.

Figure 11 shows that, within the Auckland region, the largest number of authority applications were granted in Auckland City, followed by Manukau City and Rodney District, while Papakura District had only six. These numbers may be a useful indicator of development pressure but further research is needed before any conclusions can be made.

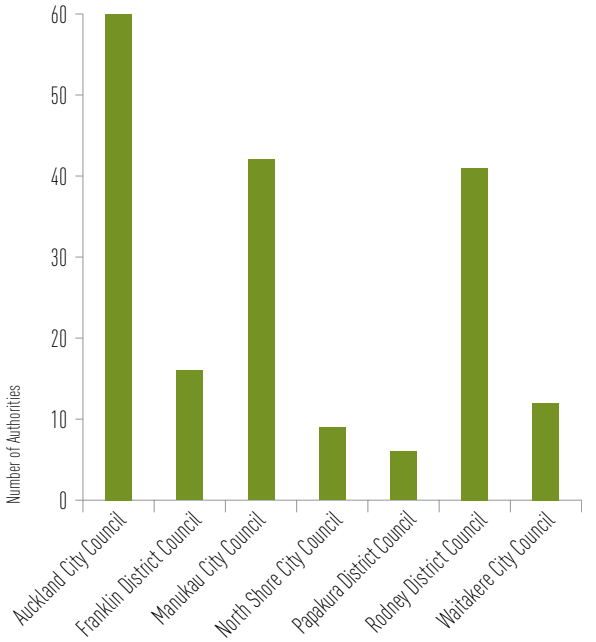

FIGURE 11 Numbers of archaeological authority applications granted by the NZHPT 2004-08, by council. (Source: NZHPT).

Figure 12 shows that the number of authority applications granted by the NZHPT doubled from 25 in 2004 to 50 in 2008. The reasons for this trend are not clear; it could be due to increased development pressure from rural subdivision and/or urban redevelopment and infill, or landowners may be more aware of the need to apply to the NZHPT for an archaeological authority.

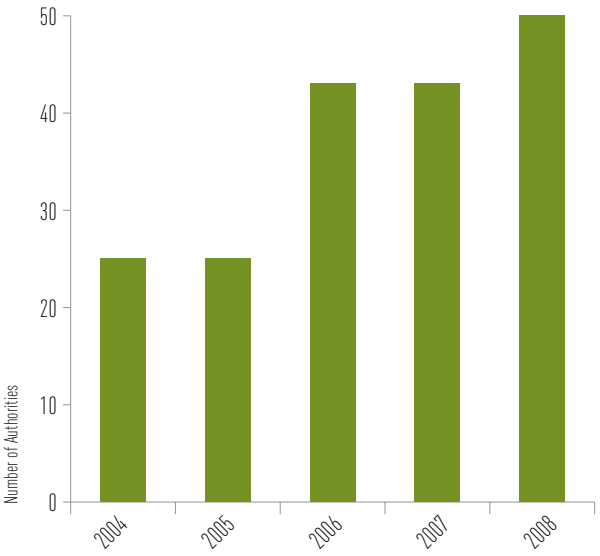

FIGURE 12 Numbers of archaeological authority applications granted by the NZHPT 2004-08. (Source: NZHPT).

5.2

Historic heritage

The five reasons for which authority applications were granted were:

- → urban development (45 per cent)
- → forestry (21 per cent)
- → utility and remedial works (14 per cent)
- → heritage investigation/conservation works (12 per cent)
- → roading/footpath (8 per cent).

Additional research into the nature and effect of the authority applications that were granted is required before any conclusions can be drawn about the extent of modification or damage consented to, or the significance of these sites.

Indicator 8: Change in condition of archaeological sites

There is very little monitoring information available to report on the condition of heritage items in the Auckland region, apart from the details provided by the New Zealand Archaeological Association (NZAA) about the condition of archaeological sites.

The condition of an archaeological site can be re-assessed for various reasons: as part of a council survey to assist with the district planning process, as part of the land development process, or as a result of:

- → an archaeological investigation undertaken by the University of Auckland
- → monitoring and site visits by ARC staff
- → surveys undertaken for archaeological authority applications
- → the NZAA site upgrade programme.

This information is used to update the existing information about known archaeological sites, including changes in their condition over time.

Figure 13 shows the various changes that have occurred since 1999. In particular, the number of intact sites has increased slightly (from 20 per cent in 1999 to about 22 per cent in 2008). The number of damaged sites has remained fairly constant, despite small fluctuations, but the number of destroyed sites has increased slightly (from 7 per cent in 1999 to 9 per cent in 2008).

A positive development is that the number of sites with no data available has declined from 9 per cent in 2009 to 3 per cent in 2008, indicating that our knowledge about the condition of archaeological sites in the Auckland region is improving.

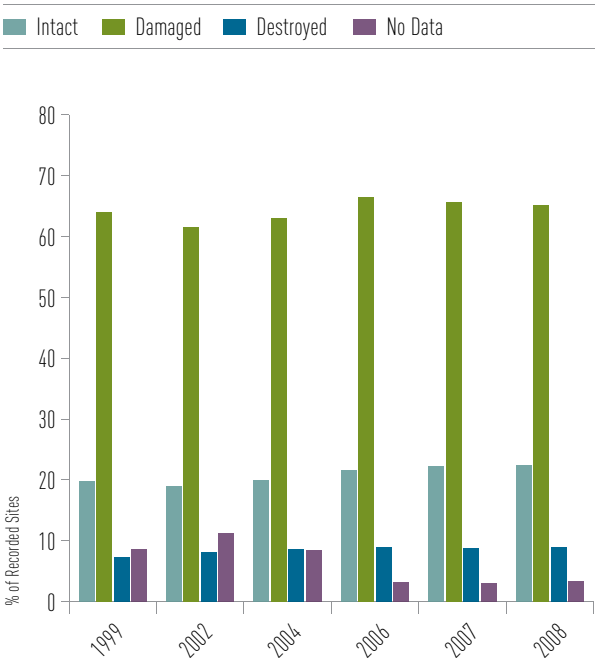

FIGURE 13 State of archeological sites in the Auckland region, 1999-2008. (Source: ARC 2008).

Historic heritage

Implications

As identification of historic heritage increases, there is a corresponding increase in our ability to protect known heritage sites and items.

The distribution of currently known heritage items in the CHI does not necessarily reflect the distribution of actual items, since survey work is often driven by development proposals. This means that rural areas and other areas with low development pressure are often not well surveyed and historic heritage within those areas may, as a consequence, be at greater risk.

The NZHPT registration of sites has had a strong focus on Auckland City. This has implications in terms of the potential availability of the National Heritage Preservation Fund which is available in the Auckland region only to Category 1 registered heritage sites. The analysis of the type of heritage sites being registered by the NZHPT suggests that Māori heritage is under-represented and, therefore, may not have adequate access to funding support.

As there is no systematic monitoring of the condition of heritage items, little is known about how heritage items are withstanding degradation from natural pressures or human activities. Consequently, our ability to respond in a co-ordinated and comprehensive manner is affected.

ARC responses

Improving our planning

The future of historic heritage in the Auckland region will be largely determined by:

- → the quality of our land use and coastal planning
- → the extent to which district and regional plans, in particular, control development in order to minimise threats to heritage items and maximise protection and enhancement.

To assist with planning, the Auckland Regional Policy Statement sets out policy to guide the evaluation of historic heritage by councils as part of their responsibility under the RMA.

All councils in existence in the Auckland region at the time of writing have identified various heritage items of significance and listed these in the schedules of their district and regional plans. For example the ARC has scheduled heritage items in the marine area in the Auckland Regional Plan: Coastal and this plan also includes rules to control activities in the Coastal Marine Area that may damage heritage items. However, the bulk of historic heritage in the Auckland region is located on land so the primary responsibility for managing the effects of development upon historic heritage rests with councils. Consequently, most information in this section relates to the responses of the councils in the Auckland region (and the ARC in regard to marine heritage).

Scheduling of heritage items

Figure 14 shows an increasing trend in the overall number of heritage items scheduled in district plans and in the Auckland Regional Plan: Coastal since 2000. In 2000, about 2205 items had been scheduled. By 2008, 2886 items were scheduled, meaning that 681 new items had been added (a 31 per cent increase).

This growth is due to additional sites being added to the heritage schedules over time, as a result of plan changes initiated by local authorities. The most substantial of these was the proposed Hauraki Gulf Islands section of the Auckland District Plan, which was notified for public submissions in 2006. More than 200 new heritage items, predominantly built heritage and archaeological sites, were added after surveys on Waiheke Island and Rangitoto Island. These accounted for about one third of the total increase in scheduled heritage items between 2000 and 2008.

However, apparent inconsistencies in the way that scheduled heritage items have been counted over time means that caution is needed when trying to identify trends or draw conclusions from this data.

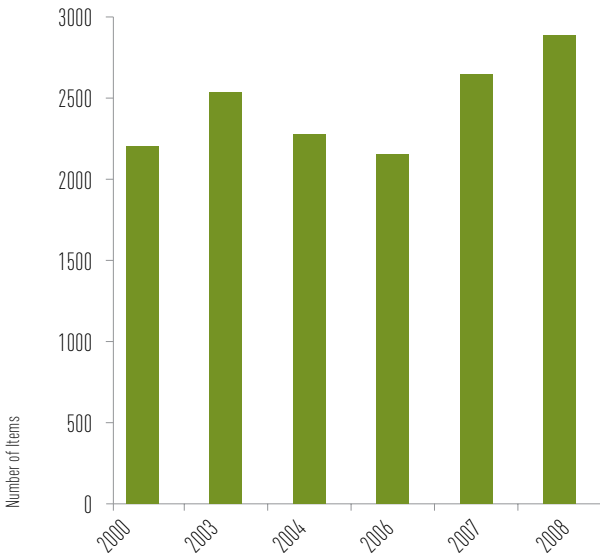

FIGURE 14 Changes in the total number of scheduled items between 2000 and 2008. (Source: ARC).

5.2

Historic heritage

Type of scheduled items

All local councils currently identify heritage buildings and other structures in schedules to their district plans and, as for the NZHPT register, these dominate the types of scheduled items.

To date, all local councils in the Auckland region have scheduled the exterior of buildings for protection, and four have also identified interior features that contribute to some of the heritage value of the item. It is less common for the site surrounds to be scheduled, and only Auckland City and Rodney District councils have specifically identified site surrounds such as gardens and other open spaces.

Archaeological sites and trees are commonly included in the heritage schedules. All councils have identified archaeological sites (although the number scheduled varies significantly across the councils) but together they reflect only a small proportion of the approximately 10,400 archaeological sites recorded in the CHI.

The ARC is the only council to not identify trees, although sites of historic botanical and ecological significance are recorded in the CHI.

Māori heritage items are considerably under-represented, with only three of the eight district/regional plans containing items with specific Māori heritage value, and all of these were first registered by the NZHPT.

Table 4 and Figure 15 show the type and proportion of heritage values identified in schedules to district plans and the Auckland Regional Plan: Coastal.

TABLE 4 Types of scheduled items identified in council plans. (Source: Local authority district plan schedules).

Council	Built			Archaeological	Māori	Trees	Geological
	Exterior	Interior	Surrounds				
Auckland City	✓	✓	✓	✓	✓	✓	✓
Franklin District	✓	×	×	✓	×	✓	×
Manukau City	✓	✓	×	✓	✓	✓	✓
North Shore City	✓	✓	×	✓	×	✓	×
Papakura District	✓	×	×	✓	×	✓	×
Rodney District	✓	×	✓	✓	×	✓	×
Waitakere City	✓	✓	×	✓	×	✓	×
Auckland Regional	✓	×	×	✓	✓	×	×
Key	✓	Scheduled in the district plan					
	×	Not scheduled in thedistrict plan					

Historic heritage

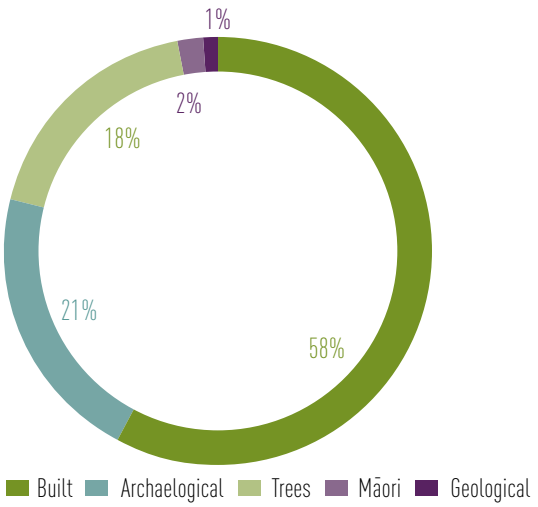

FIGURE 15 Proportion of scheduled items in district plans, by type. (Source: Local authority district plan schedules).

Regulating activities that affect heritage items

District and regional plan rules

Heritage items that are listed in heritage schedules are given a high level of protection. All of the councils in the Auckland region have scheduled items and have corresponding rules within plans that are aimed at protecting those scheduled items. In addition, many commercial and residential heritage areas and/or zones have been identified for protection on planning maps. This means that any activities with the potential to damage, diminish or destroy the heritage values of these areas or zones cannot be undertaken without resource consent.

For built heritage, rules control demolition, relocation, additions and alterations, new buildings on the site, signage, landscaping and subdivision. For sites that are significant to Māori, and for archaeological sites, these rules relate to modification, destruction, earthworks, new buildings, vegetation clearance and planting, subdivision and signage. For scheduled trees, the rules usually relate to any work to be done within the dripline of the tree, such as earthworks, building construction and pruning.

Heritage Protection Orders

These can be made under the RMA and offer strong protection when imposed by a Heritage Protection Authority, including the NZHPT and councils. Heritage Protection Orders are used very sparingly, typically when a site of significant historic value is threatened by imminent destruction or when the existing rules are insufficient.

At the time of writing, only two councils within the Auckland region have scheduled items that are subject to heritage protection orders. Auckland City has five buildings in the CBD with heritage protection orders in place and Waitakere City had one in place for the New Lynn Hotel, a council-owned building. However, this was demolished in 2008 for health and safety reasons.

Scheduling and regulation: Is it working?

The success of scheduling and the inclusion of rules in plans by individual territorial authorities can be assessed in various ways.

5.2

Historic heritage

Protection activity over time

Figure 16 shows an apparently uneven level of effort in scheduling heritage items within the Auckland region, with the Auckland City Council district plan having the greatest number of scheduled items (about 1144). More importantly, the number of scheduled items in the Auckland, North Shore, Papakura, Manukau and Waitakere district plans has increased since 2000 but there has been no increase in the Franklin and Rodney district plans or in the Auckland Regional Plan: Coastal. This uneven level of effort reflects varying levels of resourcing for historic heritage across the Auckland region.

It is also worth noting that only two councils have made changes to the historic heritage provisions in their district plans in response to the RMA Amendment (2003) that introduced new and additional historic heritage management responsibilities for councils. Auckland City Council initiated changes to a number of provisions affecting historic heritage, and in 2006 North Shore City Council notified a plan change (Plan Change 3) to strengthen the provisions of a particular residential heritage zone following a detailed assessment of resource consent outcomes and a residents' survey.

This pattern shows that, in general, the recognition of historic heritage in plans is increasing but there appears to be intra-regional variation in that trend.

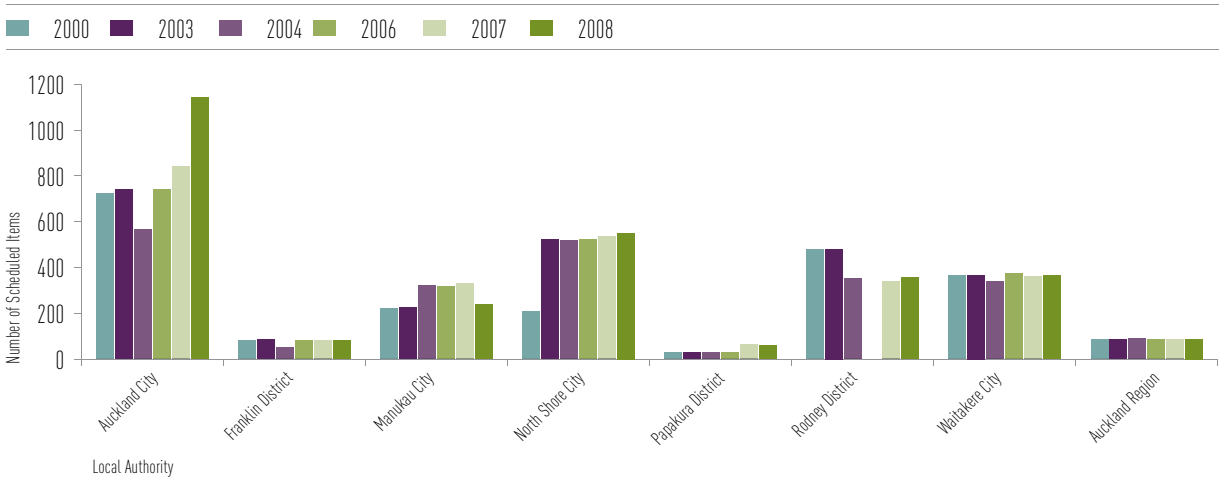

FIGURE 16 Number of schedule items 2000-2008, by council. (Source: ARC).

NZHPT review

The NZHPT recently published a nationwide study into the quality of the heritage provisions (rules) in district and regional plans. Some examples of weakness that were identified by the NZHPT within the Auckland region are the:

- Waitakere City Council District Plan. This has only limited regulation for waahi tapu (the rules relate to the alteration of any known waahi tapu rather than its damage or destruction).
- Manukau and Papakura district plans. These do not explicitly control the relocation of listed heritage items. Instead, they adopt a 'modification' rule with varying definitions.
- Several plans for the Auckland region were highlighted for the high quality of their rules:
- Auckland City and Rodney district plans. These had strong provisions to deal with the surrounds of scheduled items.
- North Shore District Plan. This was singled out for its provisions to waive development controls if a proposal would enhance the heritage values.

Non-regulatory responses to historic heritage

In addition to the regulatory mechanisms, various non-regulatory responses are used by a number of councils in the region, or are available to encourage protection, conservation and/or restoration of historic heritage.

Providing funding to assist private owners

Most councils in the Auckland region have funds to assist private owners with the cost of protecting, conserving and restoring heritage items identified in the district plans and the Auckland Regional Plan: Coastal. Examples of projects that may receive funding include:

- earthquake strengthening of buildings and structures
- repair and restoration of built heritage fabric
- maintenance of scheduled trees
- fencing to prevent damage to archaeological and Māori heritage sites
- professional services, such as the preparation of archaeological reports, conservation plans and historical research.

Historic heritage

Financial support for historic heritage funding is renewed each year through the annual planning process. The level of funding devoted to historic heritage protection by councils across the Auckland region in 2008/09 is shown in Figure 17.

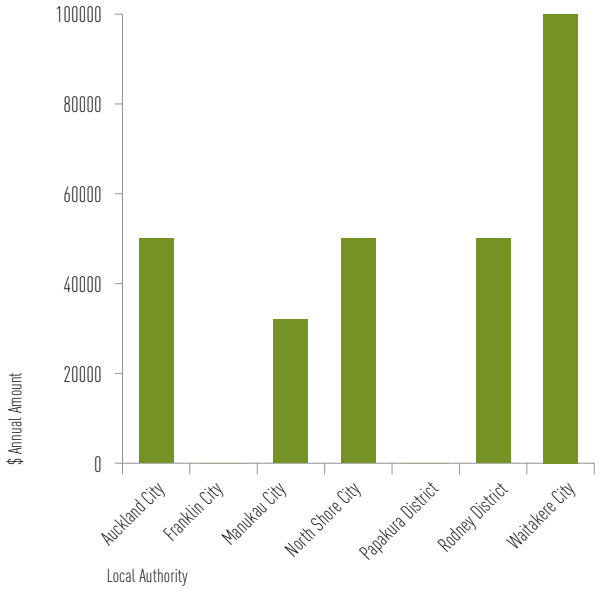

FIGURE 17 Amount of historic heritage funding provided to private owners by local authorities 2008/09. (Source: Local authority websites and personal communication).

In addition, the ARC has supported a number of historic heritage protection projects through the Environmental Initiatives Fund (see Projects funded by the Environmental Initiatives Fund, Chapter 4.6, pg 234).

Since 2003, the NZHPT has operated a National Heritage Preservation Fund worth about $500,000 annually. This provides funding for private owners of historic places, waahi tapu or waahi tapu areas that are either registered as Category I under the Historic Places Act (HPA) (1993) or that would satisfy the requirements for Category I registration. The fund covers stabilisation, repair or restoration work relating to historic buildings or structures, conservation work relating to land or archaeological sites, and a range of professional services. Nine applications from projects within Auckland city have received funding worth $519,243.

Other funding agencies (such as the New Zealand Lottery Grants Board and the ASB Trust) also provide grants for historic heritage restoration and conservation projects.

Covenants, reserves and conservation management

Other protection mechanisms used in the Auckland region include conservation covenants. These are provided for under legislation, including the HPA and the Conservation Act (1987). Covenants are attached to a land title and impose conditions or restrictions on its use. This means that they are an important mechanism for the long-term protection of historic heritage.

Under the Reserves Act (1977), land may be acquired and/or managed as a reserve by local authorities and DoC for a range of purposes (including the protection and preservation in perpetuity of places, objects and natural features of historic, archaeological, cultural, educational and other special interest). The management and use of reserves is governed by policies and strategies set out in a reserve management plan. DoC also has processes under the Conservation Act to ensure protection and management of historic heritage on conservation land.

Conclusion on the state of historic heritage

Our awareness of the amount and nature of historic heritage in the Auckland region is improving. The number of heritage items recorded on the CHI has increased steadily over the past ten years, many councils have added more heritage items to their district plan schedules and more additions are planned. Fifty-five registrations have been added to the NZHPT register since 2004 and the NZAA Site Record File is also increasing.

The amount of land in the Auckland region that has been surveyed for historic heritage is an important consideration when assessing our overall effectiveness in heritage management: if we are unaware of heritage items we cannot manage and protect them. Over the past eight years there has been a slow but steady increase in the amount of land that has been systematically surveyed and assessed for the presence of heritage sites and items.

Although there are positive trends for historic heritage in the Auckland region, it is difficult to establish a clear picture of the overall condition of historic heritage or the success of heritage provisions of district and regional plans, due to an overall lack of research and monitoring. This situation will persist until there is more awareness about the importance of monitoring in the planning process, and until councils have developed a commitment to monitoring at all levels.

In the absence of sufficient data, few conclusions can be drawn about whether historic heritage as a whole is being protected over time. At present, the best that can be done is to assess the adequacy of responses, based on the representativeness of current scheduling and registration. From this, it is clear that, although buildings and structures, archaeological sites, sites of significance to Māori, and trees are identified in the plans, the level of representativeness is questionable. Built heritage dominates both council heritage schedules and the NZHPT register while Māori heritage is substantially under-represented in district plan schedules and the NZHPT register. Therefore, more work with local hapu and iwi is required to establish appropriate processes for identifying and assessing Māori heritage values. In addition, the group values of heritage items needs to be recognised, to ensure that buildings and sites are not viewed in isolation from their surroundings.

Historic heritage

Case Study: The Value of Education – Mangere Mountain Education Centre

Education is an important tool in raising public awareness and commitment to cultural heritage protection. Many education methods are employed in the region including interpretative panels at cultural heritage sites, public talks, heritage trails, guided walks, and the provision of advice to owners by specialist heritage staff employed at the councils.

Mangere Mountain Education Centre – *Te Whare Akoranga o Te Pane o Mataaho* is an example of a unique large-scale education initiative that incorporates many of these education techniques.

Mangere Mountain is of significant spiritual value to the tāngata whenua, Te Wai-o-Hua, who named the mountain Te Pane o Mataaho (The Head of Mataaho) after Mataaho, an ancient ancestor who presides over the volcanoes of Auckland. The mountain was occupied for at least 600 years prior to colonisation. It is thought that it was once home to about 3000 people, making it one of the largest pre-colonial Polynesian settlements in the world. Many archaeological features from this long period of occupation remain, including evidence of terraced housing and kumara pits. Mangere Mountain also has one of the largest scoria cones in the Auckland volcanic field and is one of the most complete volcanic cones.

The education centre developed from an initial idea tabled in 1989 by the Auckland Regional Committee of the NZHPT for a project that covered the volcanic and cultural history of the region. Subsequently, the centre has been realised through the ongoing efforts and/or financial support of a range of agencies, including the Tamaki ki Raro Trust, DoC, Manukau City Council, ARC and the local Mountain View Primary School.

To date, an existing building has been refurbished and turned into an educational facility, a commemorative shell path has been constructed, and interpretation signs and carvings and a children's nature park have been added to the site. In addition, a wide range of activities and resources are provided by the centre, including:

- → curriculum based activities for primary and secondary schools
- → adult education programmes relating to the natural cultural and historical values of the mountain
- → guided group walks around the mountain
- → public events such as open days, walks and Matariki New Year celebrations
- → planting days, including the establishment of pa harakeke (flax plantation), rongoa (medicinal) garden, and a traditional food garden.

Since 2003, the centre has been managed by the Mangere Mountain Education Trust, whose objectives are to undertake and facilitate the study of Mangere Mountain and its related environs (including natural, historic and cultural values), provide environmental and bicultural education programmes for young people and the wider community, and make resources available to teachers, students and other interested members of the public.

Information for this case study came from a brochure produced by the Mangere Mountain Education Trust and the Mangere Mountain website – www.mangeremountain.co.nz

Photo: Mangere Mountain – Te Pane o Mataaho. (Source: Alastair Jamieson).

References and further reading

Burgess, S. (2007) *New Zealand Archaeological Association Site Recording Scheme Upgrade Project: Waitakere City Council*. Unpublished report.

Environmental Protection Agency, (2008) *State of the Environment Queensland 2007*.

Franklin District Council, (2008) *Franklin District Heritage Strategy*.

Hauraki Gulf Forum (2008) *Tikapa Moana – Hauraki Gulf State of the Environment Report 2008*. Auckland Regional Council.

Hennessy, K., Fitzharris, B., Bates, B.C., Harvey, N., Howden, S.M., Hughes, L., Salinger, J. and Warrick, R. (2007) Australia and New Zealand. Climate Change 2007: Impacts, Adaptation and Vulnerability. In: M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson (eds) Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, UK, Cambridge University Press, pp. 507-,540.

Mason, G. (2008) *Evaluating the effectiveness of conformance-based plans: attributing built heritage outcomes to plan implementation under New Zealand's Resource Management Act*. PhD thesis. University of Waikato.

Mason, G. (2008) *Review of Auckland Regional Council's Regional Policy Statement: Scoping study on historic heritage monitoring by Auckland local authorities*. Auckland Regional Council. Unpublished report.

Mason, G., and McEwan, A. (2005) *Managing change in North Shore's Residential 3 Built Heritage Zone: an evaluation of resource consent outcomes*. North Shore City Council.

New Zealand Ministry for Culture and Heritage and Statistics New Zealand. (2006) *Cultural indicators for New Zealand*.

McClean, R. (2009) *Historic Heritage Research Paper No. 2: National assessment of district plan heritage provisions*. New Zealand Historic Places Trust.

McClean, R. (2007) *Sustainable Management of Historic Heritage Guide No. 5: State of the Environment reporting and monitoring*. New Zealand Historic Places Trust.

New Zealand Historic Places Trust. (2004) *Heritage management guidelines for resource management practitioners*.

Opus International Consultants Limited. (2007) *Heritage protection indicator report. New Zealand Ministry for Culture and Heritage*. Unpublished report.

Randerson, T. (1997) Resource Management Act 1991. In: D.A.R. Williams (ed.), *Environmental and resource management law* (2nd ed.). Wellington, Butterworths, pp. 55-119.

Skelton, P. (2004) *Identifying our heritage: a review of registration procedures under the Historic Places Act, 1993*. New Zealand Historic Places Trust.

Tatton, K. (2001) *Cultural heritage in the Auckland region: priority areas for survey and assessment*. Auckland Regional Council.

Photo: Whakanewha Regional Park, Waiheke Island. (Source: ARC)

6.0

Conclusion – State of the Auckland environment

Contents 6.0

Conclusion

The complexity of natural systems is such that we may never know as much as we would like to about the state of our environment. We are only just beginning to understand the intricate relationships between species, populations and ecosystems, and also the interactions with people, both immediate and cumulative. However, as this report shows, we do know a great deal about many aspects of our environment based on over 20 years of monitoring and research.

This report sets out in detail what we do know about the environment – but what does this tell us? What should we take from this information as we look to the future?

Each chapter records 'key findings' and those are not repeated here, rather the critical issues identified through this report are summarised as follows[1]:

- Although the overall picture is variable, most indicators suggest that the pressures of consumption and production continue largely unabated. With a growing population forecast, much depends on our future success in decoupling population and economic growth from production and consumption and/or the negative impacts of that production and consumption on the environment. In short, we need to become more resource efficient. That will require both technical advances and behavioural change. On that front, while rates of water consumption have fallen to internationally modest levels, there are challenges ahead in managing solid waste, energy demand and transport.
- Loss of land to urbanisation continues. Notwithstanding the Auckland Regional Growth Strategy, we continue to lose prime agricultural land to urbanisation. Outside the MUL residential development is intensifying – sometimes in environmentally sensitive locations. Rural activities are exposing land to increased risk of erosion, soil degradation and sediment loss to aquatic environments.
- With respect to air quality, emissions of PM_{10} and $PM_{2.5}$ particulates and NO_2 all need to be reduced substantially to meet national standards and protect human health. Motor vehicles and domestic heating are the major contributors of these pollutants.
- Water quality and ecological health in the region's rivers are highly influenced by land cover in the catchment. Most of the rivers and lakes in the region are degraded to some extent. Urbanised catchments generally have poorest water quality although there are signs that this is improving. Lake water quality is degraded due principally to nutrient enrichment and invasion by exotic species.
- Plumes of sediment are often visible in the marine environment following large storms, with water clarity often taking several days to improve. Increased sedimentation is a real and significant impact impinging on aquatic environments. Large sediment runoff events can lead to sediment dumps, which smother marine life. Ongoing, incessant sedimentation leads to the slow, irreversible degradation of the marine environment, particularly in sheltered harbours and estuaries. Clear signs of this include increases in the "muddiness" of estuaries and mangrove expansion.
- Heavy metal contaminants in estuarine muddy habitats are impacting upon marine species leading to a decline in ecosystems adjacent to urbanised catchments. Concentrations of zinc in the sediments of estuaries and harbours are increasing and new organic contaminants are emerging as potential concerns. The stormwater system is the primary transporter of these contaminants. The ARC's modelling shows that stormwater is contributing large volumes of sediment, zinc, copper and bacteria to aquatic systems. Zinc levels tend to be high from catchments with historically high industrial landuse. The extent of impervious surface within the metropolitan area has increased giving rise to greater stormwater volumes and contaminant loads. In addition there are a large number overflows from the Auckland combined stormwater/wastewater system during wet weather, which will continue until these systems are fully separated.
- Coastal water quality around the region is generally improving. However, at some high quality sites there is an apparent decline in water quality due, in part, to continued input of sediment and nutrients from rural catchments.
- The region retains only 27 per cent of indigenous land cover but fortunately still contains a diverse range of New Zealand's terrestrial biodiversity. Several ecosystem types are severely depleted in the region and are under threat from further loss and fragmentation of habitats (as a result of urban or rural land development) and the impacts of invasive species.
- Like most parts of the country, the Auckland region is exposed to a range of geological, climatic and coastal hazards. The majority of recent events have related to climatic hazards (flooding, landslides and cliff instability). Our vulnerability to these hazards changes over time as a result of our preparedness and our management of development and land use activities. Unfortunately, Aucklanders are generally not well prepared for natural hazards and lag well behind other regions.
- We know that efforts to record and give protected status to historic heritage have increased considerably in recent years. However, we know little about what is happening to historic heritage that is not already recorded and is potentially at risk from activities that do not require resource consent. Furthermore, we know little about the condition of some of the recorded resources and their vulnerability to natural or human induced deterioration. There are examples where historic heritage has degraded due to neglect, to the extent that demolition is the likely outcome.

Many of the negative trends highlighted in this report occur despite regulatory efforts by the ARC and other authorities. This illustrates that while regulation is important (and has probably been critical to arresting decline in the state of some natural resources) the mitigation of impacts possible through individual consent practices is limited. In reality, consented activities will still contribute to many of the environmental problems we face. This means that effective environmental management will always require more than simply requiring, considering, issuing and enforcing consents for individual activities. It will require careful planning (where trade-offs are made at a higher level), community and landowner

[1] A more comprehensive review of all the issues raised is repeated in the executive summary

engagement, public investment, inducements and initiatives. In doing so, we must carefully consider where the costs and benefits for these types of interventions lie to ensure that they are fairly and equitably allocated between the public and private sectors, without loading costs onto future generations.

It is also important to note that even after we have intervened it will take time, often decades, for results to be apparent in monitoring data.

This conclusion focuses on four key questions:

- How do current ARC priorities (measured by investment and policy attention) match against the critical issues outlined above?
- Where are we heading given the identified trends and current responses?
- How durable are the gains the ARC has already made?
- What challenges and opportunities lie ahead?

Current issues and priorities

Whilst the ARC has a broad portfolio of activity, like all organisations it has limited resources meaning it must prioritise where its efforts are directed. Amidst the reorganisation of Auckland governance and a global economic recession, the business of infrastructure provision (wastewater networks, transport systems, electrification and broadband), managing urban growth and rural productivity, and the protection of open space, landscapes and biodiversity must continue.

In recent years the ARC (together with its subsidiary, ARH) has directed by far the greatest proportion of its available financial resource into transport, specifically public transport delivered through ARTA. Public transport investment contributes towards improving air and stormwater quality, reducing land development impacts by reducing the need for road building and promoting urban intensification, and energy conservation.

Considerable resources are allocated to the acquisition, development and maintenance of regional parks. The parks are varied in size, nature, and purpose but many contribute to a range of environmental outcomes. The maintenance of open space, rural and coastal landscapes, and associated amenity is an obvious benefit of the park network. Also, parks are an important refuge for the protection and enhancement of indigenous biodiversity, and maintenance of freshwater quality. Further benefits accrue by reducing potential vulnerability to natural hazards particularly coastal flooding and erosion by ensuring key coastal land cannot be subject to development.

Other priorities include *stormwater management* and *pollution response*, which make an important contribution to water quality, ecosystem health and flood management. *Growth management* involves developing, supporting and monitoring the Auckland Regional Growth Strategy which focuses effort on integrating transport and land use planning with the aim of achieving a compact urban form. *Pest management* makes a major contribution to biodiversity protection across the region and specifically on regional parks. Priorities also extent to air, land, water and heritage management with much of this activity on planning and consent processing, monitoring and research, and assistance to individuals and groups through targeted programmes and partnerships.

It is clear from the above that at least at the broad level, our current spending priorities, and the outcomes we seek from them, match well against most of the critical issues identified in this report. Sometimes they do so directly and sometimes indirectly.

The work of the ARC is complemented by many other agencies including city and district councils, central government and non-governmental organisations and charities. Much of this work is directed and constrained by mandatory functions set out in various statutes and by regional community though the public processes required by those statutes.

In summary, although there will always be debate about which is the best approach to address each issue we can be confident that we are broadly on track given the responsibilities and powers we have.

Where we're heading

This report tells us a lot about where we are at and where we've been but what does it tell us about where we're heading? If we keep going with current trends and current responses what might our environment be like by the time the next state of the environment report is written? What about in the years beyond that as we move towards a population of two million?

Based on us continuing as we are, our future environment is likely to be as follows:

- Our air quality is likely to be similar to what we have today. Overall emissions from vehicles will be about the same despite improvements in vehicle technology simply because there are likely to be more kilometres travelled (notwithstanding public transport investment). Emissions from domestic home heating may decrease slowly but only to the extent that we meet internationally accepted air quality standards in about 25 years time. Although air quality is likely to remain the same, a larger and denser population will see more people exposed to air pollution with associated increases in mortality and reduced activity days (days when people feel too unwell to do their normal activities).
- Our freshwater quality is likely to be similar to today. Although we have clearly made gains in urban water quality in recent years it is likely that we have exhausted the potential improvements using the current approach to managing discharges. Freshwater quality in rural areas is similarly likely to stay the same although some marginal improvement may be expected if non regulatory approaches are effective. Opportunities for greater improvements abound, particularly if initiatives to improve riparian management are implemented. Rivers flowing through catchments converted from intensive rural land use to lifestyle blocks are likely to see water quality improvements through reductions in bacteria and nutrient levels and, in some cases, temperature. Some further deterioration of already degraded urban and rural rivers is likely as degraded rivers tend to receive little protection from activities that lead to further degradation. Exotic species are likely to continue to degrade lake water quality and ecology.

Conclusion

- Rural land will continue to be converted to urban uses and smaller rural parcels at a rate similar to today. Natural erosion of rural soils will fluctuate according to climatic events. Land disturbance will continue with bare soil potentially generating sediment. The propensity for this to occur will depend on land use and land management practices that are likely to be targeted in the review of the Auckland Regional Policy Statement. Soil quality is likely to degrade further with increased compaction, excess nutrients and changes in soil carbon levels which effect soil structure and nutrient retention.
- Our marine area is likely to continue to decline at a gradual rate, with many changes too subtle to observe until it is too late. Key changes are likely to be a decline in species diversity and loss of large species. Currently the most degraded marine areas are close to the centre of Auckland reflecting land use impacts. However this footprint of impact may spread further along Auckland's coastline as rural land practices generate discharges of nutrients and sediments and urban Auckland expands. While we have new technologies to reduce inputs from stormwater, the suite of contaminants we are dealing with is an increasingly complex mix and the cost of intervention can be prohibitive. As the region's population expands there will be increased access to, and use of, the marine environment creating additional pressures on marine resources such as space, food resources and minerals.
- At the regional scale, native habitats and threatened species will continue to decline in unprotected or unmanaged areas due to habitat loss, fragmentation and invasive species. Although there will be site-specific gains though individual and community driven efforts involving covenanting, pest control and revegetation as well as biodiversity recovery in regional parks.
- Natural hazards will continue to impact people and property in the Auckland region. As population growth and urban expansion increases, new areas will be exposed to natural hazards while the potential consequences of an event may become greater, even if the magnitude of environmental processes have not increased. The awareness of natural hazards, their impacts and the preparedness of communities and businesses is likely to remain an ongoing issue.

Overall, we need to recognise that as our population and economy grows and intensifies greater pressure will be put on our environment. Fortunately the quality of environmental management has also tended to improve over time and we have been able to apply better knowledge and technology to meet these challenges. There is little doubt though that unless we continue to improve our management of the environment some of the negative trends we see today will likely continue or even accelerate in the years ahead.

The gains we've made

While we began this concluding chapter focussing on the challenges we face, it is important also to recognise the gains we have made. There have been many and some are very significant. It is also important to recall that, while some of these gains are likely to be permanent because we have achieved a technological shift (such as improved vehicle emissions, or stormwater treatment), others remain vulnerable and can be easily lost.

In this 'vulnerable' category are those gains that relate to human behaviours and natural processes and/or which are dependent on organisational priority setting.

The most important gains vulnerable to reversal include:

- Pest management where many of millions of dollars have been spent to get pest numbers in ecologically important areas down to levels that do not impact significantly on biodiversity. Reducing effort in pest management could jeopardise past gains with pest populations able to rebuild in relatively short timeframes.
- Public transport that has seen huge growth in patronage as a result of greatly improved services and promotion to encourage people to use buses and trains. Reducing funding of public transport is likely to arrest these gains land potentially see people return to their cars.
- Urban growth management and the gradual buy-in to the idea that we need to move away from continual "build at the periphery" approach to accommodating urban growth. The development community has come a long way from the days of endless low rise sprawl and is embracing new forms of development that can position Auckland to grow with much less environmental impact.
- Community and landowner awareness of environmental issues and of their contribution to those issues and their resolution. In particular, the adoption of best practices in land management and maintaining community involvement in care groups is highly vulnerable to any withdrawal in effort.
- Environmental information that we have gained through years of building and refining monitoring programmes and recording data. This has enabled us to understand long term trends, make better management decisions and evaluate whether we are making a difference.

Looking ahead: the challenges and opportunities

Looking ahead it is clear that if we keep to the current path we will see some environmental gains occurring within an environment that is in gradual decline. Some of the hard won gains are potentially at risk if investment is not maintained and in some areas increased. But this outlook presents as many opportunities as it does challenges.

In many ways the information in this report confirms that we have exhausted the easy opportunities for environmental improvement, just as we should have. Like other cities in New Zealand and around the developed world we are at the cusp of a new era in environmental management. The relatively easy-to-deal-with point sources of pollution have been regulated and cleaned up. In Auckland, this is best illustrated by our success with improving wastewater discharges beginning with the relocation of wastewater

treatment to Mangere in the 1960s and the subsequent upgrade of many smaller treatment facilities and dairy shed discharges during the 1990s and 2000s. Air discharges from industry have also reduced.

Over the next decade we face the task of addressing the more challenging *diffuse* sources of pollution. These are discharges that do not emanate from a single pipe or stack, or even a single user but rather from multiple, small, difficult-to-target sources. Particular examples of concern include run-off from land into surface or ground water following rainfall or the cumulative contribution of many home fires burning during winter. This new focus will necessitate greater landowner and stakeholder engagement to manage land use practices more effectively.

This may also involve looking 'up the pipe' to focus on what happens before a discharge occurs and controlling contaminants at source (such as low impact design to stormwater and land management, which is a more proactive and more cost effective way to reduce pollution). In rural areas it will mean much greater scrutiny of land management practices.

These diffuse discharges mean we need greater integrated management across land and water resources. This is not a new concept but we have yet to fully realise its potential. In essence it means we need to manage the land to take care of the freshwater and marine environments. Managing the marine environment starts at the top of our highest ranges and hills. If we are good stewards of the land and better understand and take account of the multiple stresses the use of land causes, our aquatic environments stand a much better chance of providing the full range of ecosystem and recreational opportunities Aucklanders value so highly.

The idea of diffuse risk has parallels in the management of biodiversity where risks to habitats and species are now seldom from large scale land clearance but rather from hundreds and thousands of small scale impacts associated with disturbance to exposed edges of habitat and the diffuse impacts of pests. As with diffuse pollution, managing diffuse risk to indigenous biota and habitat is challenging because each contributing activity may in isolation be trivial but cumulatively they are a heavy burden on the environment.

Diffuse risks are difficult to regulate and can be expensive to address. In looking forward we will need to consider how to extract the best environmental dividend from the resources available. This may mean reconsidering existing priorities. We know for example that making gains in badly degraded urban environments can be very expensive and often the marginal gains from each dollar invested are small. On the other hand, in some of the region's less developed but still degraded rural areas, relatively modest investment can produce substantial environmental improvement. With a fixed environmental budget we will need to think hard about where and how we should spend it to get maximum benefit for the region as a whole. This is likely to involve better targeting of funding to achieve best return on investment.

The challenges of the next 20 years may well require tools that we do not currently have and powers that we may never have. This will mean that we need to maintain a close working relationship with others, including central government. Our future success in securing good environmental outcomes for the region will always depend in part on convincing central government of the importance of our work. Whether it is acquiring a modern public transport system or introducing national regulations on fuel standards an effective partnership with central government will be a key to success.

The future management of our environment will not be without debate. We will inevitably face conflicts between competing objectives. We know already that we need to manage intensification of metropolitan Auckland carefully if we are to avoid exposing more people to greater air pollution. We also know that in seeking to retain rural Auckland in primary productive use we need to be conscious of the impacts of such use particularly as the sector moves to more intensive production. We know too that the principle of "polluter pays" can be difficult when it extends to managing diffuse sources of contaminants and that the allocation of costs for resource management must be finely balanced between public and private cost and benefits. Our need to successfully reconcile these conflicts will grow in the years ahead.

Even more fundamentally, in managing our environment we need to be conscious of the difficult social and economic challenges that our region also faces. If care is not taken, our environmental management can exacerbate some of these challenges. Housing availability and consequential issues of affordability and overcrowding are some such issues. In all we do to manage the environment – in setting standards and in making a call on scarce public resources – we need to be cognisant of the implications for the people of Auckland and their ability to sustain happy, health lives and businesses.

On a positive note, the Auckland governance reform offers a real opportunity to more effectively address many of the issues that have proved difficult historically. Urban growth management and stormwater and wastewater system performance, in particular, are issues that require close integration between regional and territorial tiers of government. Moving to a single governance structure for the region offers an opportunity to move ahead on these and other issues with much greater confidence and efficiency. The settling of Treaty of Waitangi grievances and the aspirations of tangata whenua for co-management present yet more opportunities to exercise stewardship and kaitiakitanga in the best interests of all Aucklanders.

Finally, the future environment of Auckland and the challenges we face will evolve as climate change makes its presence felt. Every resource issue from air quality to biodiversity, stormwater to hazard management could be exacerbated by changes in temperature, precipitation and sea level.

For all the reasons above, the future will mean that choices need to be made between different objectives and outcomes. We cannot always "have it all". This means that we need to establish clear regional goals and priorities. For a sustainable future many of these need to be set with the long-term view in mind – 50 to 100 years ahead – rather that the statutory planning horizon of 10 years that so often frames our work and limits our vision.

These are the challenges that lie ahead. They are challenges we must, and will, meet because our environment is worth the effort.

Acronyms & abbreviations

2004 Report	State of the Auckland Region Report 2004
ACC	Auckland City Council
ANZECC	Australian and New Zealand Environment and Conservation Council
ARC	Auckland Regional Council – Te Rauhitanga Taiao
ARH	Auckland Regional Holdings
ARPS	Auckland Regional Policy Statement
ARTA	Auckland Regional Transport Authority (formerly Transit)
ASF	Auckland Sustainability Framework
BOD	Biochemical Oxygen Demand
CCMP	Coastal Compartment Management Plan
CEF	Coastal Enhancement Fund
CHI	Cultural Heritage Inventory
CMA	Coastal Marine Area
DOC	Department of Conservation – Te Papa Atawhai
DRP	Dissolved Reactive Phosphorous
ED	Ecological District
EIF	Environmental Initiatives Fund
ENSO	El Niño Southern Oscillation
FDC	Franklin District Council
FORST	Foundation for Research, Science and Technology – Tuapapa Rangahau Putaiao
GIS	Geographic Information System
GDP	Gross Domestic Product
GNS Science	Institute of Geological and Nuclear Sciences – Te Pu Ao
GRP	Gross Regional Product
HCV	High Conservation Value
HPA	Historic Places Act (1993)
IA	Infrastructure Auckland
ICMP	Integrated Catchment Management Plan
LCDB	Land Cover Database
MCC	Manukau City Council – Te Kaunihera o Manukau
MCH	Ministry for Culture and Heritage – Te Manatu Taonga
MAF	Ministry of Agriculture and Forestry – Te Manatu Ahuwhenua, Ngaherehere
MED	Ministry of Economic Development – Manatu ohanga
MfE	Ministry for the Environment – Manatu mo te Taiao
MFish	Ministry of Fisheries – Te Tautiaki i nga tini a Tangaroa

Acronyms & abbreviations

MMA	Mooring Management Area
MOH	Ministry of Health – Manatu Hauora
MORST	Ministry of Research, Science, and Technology – Te Manatu Putaiao
MUL	Metropolitan Urban Limit (Figure 2, Part 1)
NES	National Environmental Standards
NIWA	National Institute of Water and Atmospheric Research Limited – Taihoro Nukurangi
NSCC	North Shore City Council
NZAA	New Zealand Archaeological Association
NZHPT	New Zealand Historic Places Trust – Pouhere Taonga
NZTA	New Zealand Transport Agency
PDC	Papakura District Council
QE II	Queen Elizabeth II National Trust
RDC	Rodney District Council
RMA	Resource Management Act (1991)
RPMS	Regional Pest Management Strategy
SNA	Significant Natural Area
SSWI	Sites of Special Wildlife Interest
SWAP	Auckland Regional Stormwater Action Plan
TLA	Territorial Local Authority
Treaty	Treaty of Waitangi – Te Tiriti o Waitangi
VKT	Vehicle Kilometres Travelled
VOC	Volatile Organic Compound
WCC	Waitakere District Council – Te Taiao o Waitakere
WERI	Wetlands of Ecological and Representative Importance
WHO	World Health Organisation

Auckland Regional Council – Te Rauhītanga Taiao

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