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Pressures: consumption and production

TABLE 4 Extent of impervious surfaces in 2000 and 2008. (Source: Landcare Research).

Territorial authority	Area mapped (hectares)	% impervious	
		2000	2008
Auckland City	15,376	48	50
Manukau City	14,910	39	49
North Shore City	10,584	37	36
Papakura District	3523	27	37
Waitakere City	9198	32	29
Total	**53,649**	**39**	**42**

Rural land use change

Indicator 7: Livestock numbers

The rural economy in the Auckland region is changing. The most noticeable change over recent years has been the decline of pastoral activities, particularly sheep and beef farming, and dairy farming.

The number of beef cattle, dairy cattle and sheep in the Auckland region declined by 16, 23 and 28 per cent respectively between 2002 and 2008 (Figure 5). Despite this, pastoral farming remains an important part of the rural economy in some parts of the Auckland region.

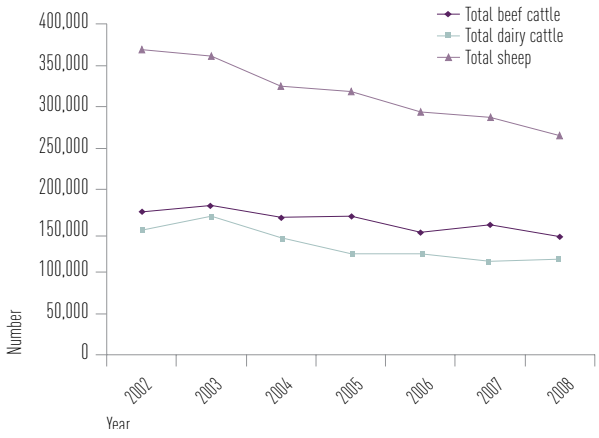

FIGURE 5 Numbers of livestock within the Auckland region, June 2002-08. (Source: Statistics New Zealand).

Indicator 8: Intensity of dairying

Data from the Livestock Improvement Corporation suggest that, since 2002, the number of dairy farms decreased by 33 per cent and the number of effective hectares in dairying decreased by 24.5 per cent.

Despite the decline in cows, farms and land area devoted to dairying, the intensity of production appears to be increasing on the remaining dairying farms. The size of the average dairy farm is increasing. This is reflected in data that show the average herd size increased 21 per cent between 2002 and 2008. Table 5 shows that the average stocking rate also increased (by 5 per cent) over this period.

TABLE 5 Dairy farming area, herd size and stocking rates within the Auckland region. 2002-08. (Source: Livestock Improvement Corporation).

	Effective farming area (hectares)	Average herd size	Average stocking rate (cows/ hectare)
2002	61,393	199	2.34
2003	59,762	205	2.33
2004	56,846	216	2.39
2005	53,650	221	2.40
2006	50,381	224	2.41
2007	48,358	233	2.43
2008	46,361	240	2.46
% change 2002-08	-24	21	5.0

Indicator 9: Horticultural land use

In contrast to pastoral farming, horticulture remains a strong rural activity in the Auckland region. Between 2002 and 2007, an additional 210 hectares were devoted to horticulture (a 2 per cent increase).

The main trend was a decline in orcharding, with all major fruit crops showing declines in terms of the area under cultivation between 2002 and 2007. However, Table 6 shows that the area under cultivation for vegetable production appeared to increase by about 25 per cent over the same period. There were some large changes in the type of crops being grown, probably in response to market factors (such as the price of particular products) and the need to rotate crops for soil health and pest management.

In addition, there is evidence of increasing intensity of production in horticulture, with the construction of large greenhouse facilities in Franklin and Rodney districts, and increased employment in plant nurseries and vineyards.

Although there is little data, it is unlikely that market gardening has expanded at the expense of orcharding. It is more likely that land formerly used for orcharding has been urbanised or changed to rural residential (lifestyle blocks), with market gardening expanding onto land formerly used for pasture.

Pressures: consumption and production

TABLE 6 Area (hectares) under cultivation, by crop type, 2002 and 2007. (Source: Statistics New Zealand).

	2002	2007	% change
Orchard crops	1,996	1,374	-31
Vegetable crops	4,227	5,294	25
Other (including flowers)	2,460	2,224	-9
Total	**8,683**	**8,892**	**2**

Indicator 10: Rural subdivision in potentially sensitive areas

Although the majority of residential development in the Auckland region has occurred within the urban area, there has also been residential growth in some coastal and peri-urban areas that may be sensitive. (Table 7).

Four categories of ecological features were used to measure the pressure of rural subsidiaries. There has been a steady increase in the number of land parcels within each category. Although the number of land parcels can change without any accompanying changes in land use and intensity, the data are an indicator of the potential increase in pressure on ecological features and sensitive areas.

TABLE 7 Number of land parcels located close to important ecological features between 1998 and 2008. (Source: ARC).

Year	Parcels above aquifers	Parcels within 200m of native vegetation	Parcels within 1km of the coast	Parcels within 200m of wetland
1998	110,570	145,538	219,455	4,732
2001	117,427	152,174	229,058	4,765
2004	122,456	157,566	236,839	4,749
2008	129,856	166,014	247,280	4,797

Indicator 11: Rural fragmentation

Rural fragmentation is the ongoing subdivision of rural land that leads to increasingly smaller land parcels. It occurs when large land parcels used for agriculture are subdivided into small and more intensive production units, hobby farms or lifestyle blocks for residential use. Rural fragmentation increases settlement density and also excludes land uses such as pastoral farming that require large land parcels.

Figure 6 shows an increase in the number of land parcels across each size category between 1998 and 2008, with the greatest increase (36 per cent) in the one-to-two hectare category. There was a corresponding decline in the number of land parcels over eight hectares.

Figure 7 shows the density by location of land outside the Metropolitan Urban Limits that has been subdivided into smaller land parcels (less than eight hectares). The areas that have undergone the greatest increases in density are those to the immediate north, west and south-east of the city, as well as areas that are close to major transport routes. The coastal area around Omaha has undergone major fragmentation.

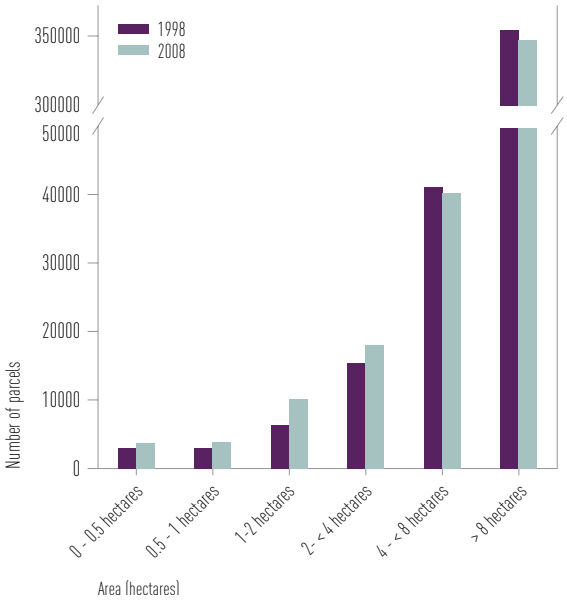

FIGURE 6 Number of land parcels by size (hectares), 1998 and 2008. (Source: Landcare Research and ARC).

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Pressures: consumption and production

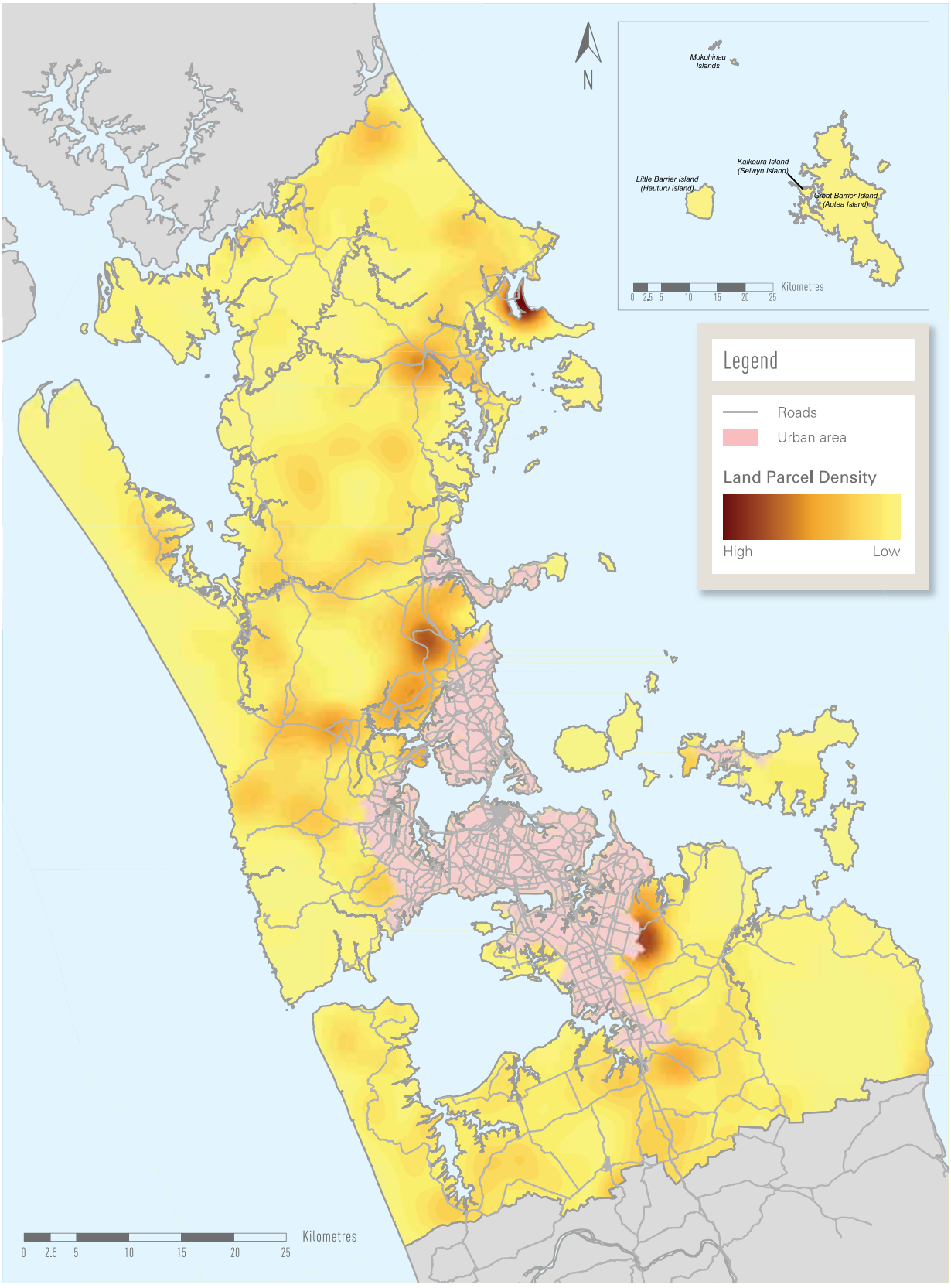

FIGURE 7 Land parcel densities outside the urban area, 2008. (Source: ARC).

Pressures: consumption and production

Land and stream disturbance

Indicator 12: Land disturbance associated with building and infrastructure development

In the urban and peri-urban parts of Auckland, earthworks associated with building projects are a major cause of soil disturbance. Earthworks typically strip the vegetation and topsoil from the land surface and recontour the site so that it is more suitable for the proposed land use. During this process, the soil is compacted, buried or displaced. The increased sediment that is generated from earthworks can be flushed into rivers, where it can have adverse impacts on the water quality of freshwater and marine environments.

Figure 8 shows the location of major earthworks during February 2007. Most, but not all, were associated with the preparation of land for housing, roading and other urban development. Earthworks associated with major highway projects (such as the motorway extension from Orewa to Puhoi) are shown, with other large clusters at the urban fringes of Silverdale, Albany, west Auckland, Flatbush and Hingaia as well as those at some inner-city development nodes such as Mt Wellington. Earthworks associated with development pressure in the rapidly growing satellite towns of Pukekohe in the south and Orewa in the north are also visible. Overall, about 400 hectares of land was subject to earthworks at this time.

Many other earthworks are undertaken, either as permitted activities or with consent required only from the local city or district council. These are not shown on Figure 8 so the actual amount of land subject to earthworks is likely to be higher.

Indicator 13: Stream disturbance

Stream disturbance often accompanies urban land use and expansion. Common stream disturbances include piping, lining and channelling. In rural areas, streams are often 'cleaned', where vegetation and sediment are removed from the channel to 'improve' the water flow, channels straightened and culverts installed to allow the passage of stock and vehicles. Damming is also common, both to ensure a reliable supply of water for irrigation and for amenity value. All of these activities can have various adverse effects on the water quality, ecology and flood management.

Between 2000 and 2008, about 80km of streams (an average of 8.9km each year) were subject to a resource consent for stream disturbance. (Table 8). This figure does not include the large number of stream disturbance activities that can be undertaken without a resource consent. Consequently the total amount of stream disturbance in the Auckland region is underestimated.

TABLE 8 Length of streams subject to consent for disturbance, 2000-08. (Source: ARC).

Financial year ending	Stream length (m)
2000	9,197
2001	11,368
2002	11,961
2003	11,035
2004	7,058
2005	12,159
2006	7,146
2007	3,669
2008	7,146

Rural land use and soil disturbance

Rural land use is the largest contributor to soil disturbance. Activities such as vegetation removal, farming of steep countryside, and extensive cultivation lead to poor soil structure and increased sediment generation.

Rural land uses create related pressures on the soil and water quality from activities such as:

- → intensive cropping leading to depletion of soil nutrients and organic matter
- → the application of fertilisers that affect water quality through excess nutrient runoff into rivers and leaching into groundwater
- → soil compaction from stock treading and vehicle traffic.

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Pressures: consumption and production

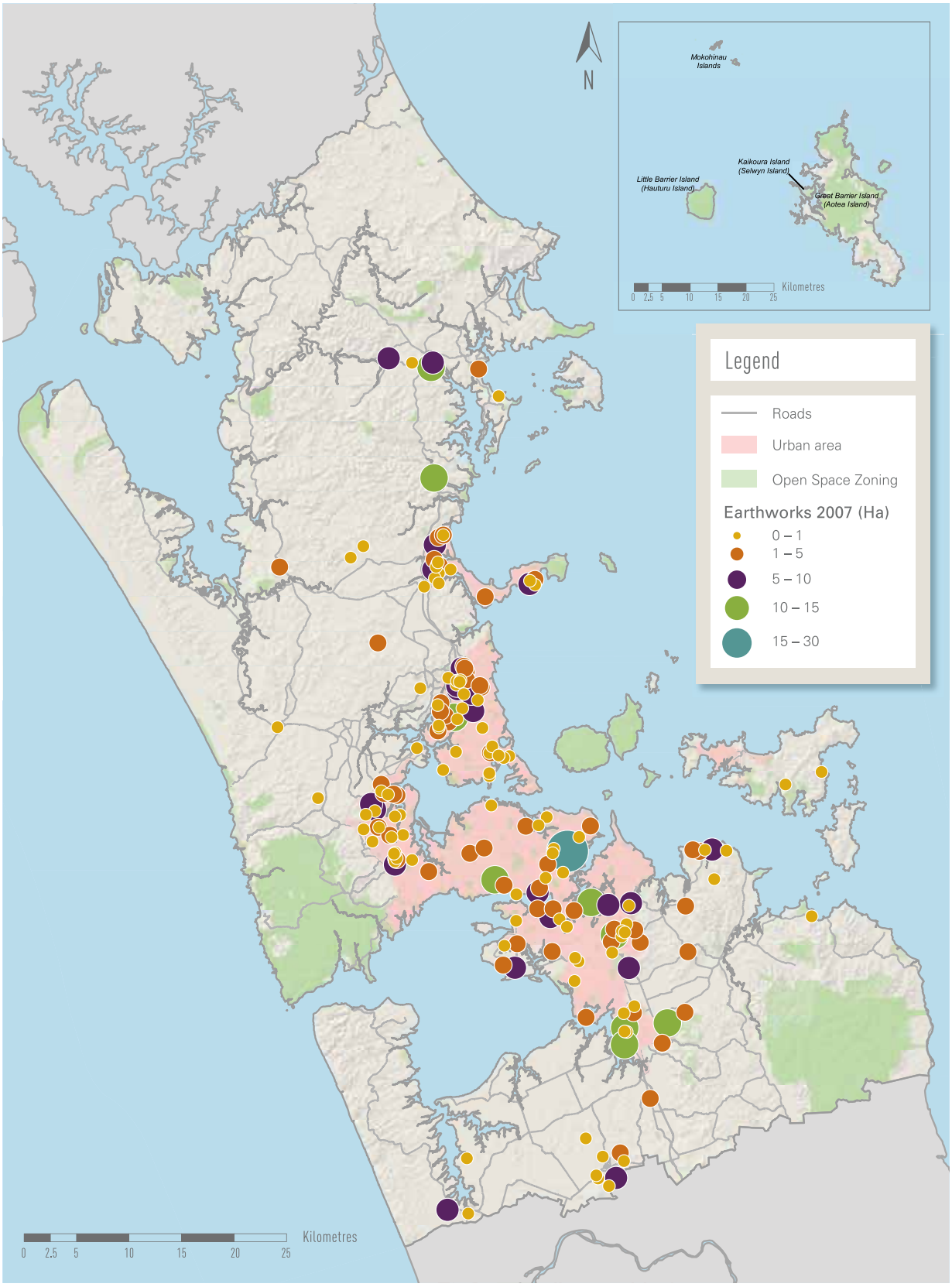

FIGURE 8 Locations of major earthworks activities, February 2007. (Source: ARC).

Pressures: consumption and production

Seabed use

Pressures on the environment do not stop at the coastline. A variety of activities are undertaken within the Coastal Marine Area (CMA) in order to meet the recreational requirements and safety demands of a growing population as well as the resource demands of a growing economy.

Coastal structures

A variety of structures such as boardwalks, breakwaters, jetties, boat ramps, bridges and groynes are found within the CMA (Table 9). Although many of these structures are beneficial they can also:

- → place pressure on the natural values of the coastal environment
- → result in exclusive use that restricts public access to open space
- → adversely impact the natural visual amenity values.

Table 9 summarises the number of current resource consents granted for coastal structures within the Auckland region, as well as the current number of applications. Some of the most heavily developed sections of the coast (in terms of coastal structures) are the Waitemata Harbour, Tamaki Estuary and East Coast Bays. In contrast, Mahurangi Harbour, Kaipara Harbour and the west coast contain relatively few consented coastal structures.

Moorings and marinas

In the Auckland region, 4610 moorings are currently located within specifically designated Mooring Management Areas (MMAs). In addition, there are about 450 unconsented moorings outside the MMAs. These figures include only known moorings and are, therefore, likely to underestimate the actual number.

A 2006 study by the ARC found that demand for moorings within the inner Waitemata Harbour MMAs declined between 1995 and 2006, by approximately 1472. This reduction was attributed to marina berths and other more convenient facilities becoming available. However, along the Rodney coast (including Kawau Island), and at Waiheke Island, Rakino Island and Great Barrier Island, the number of mooring sites increased over the same period. Pressure on the CMA for moorings and marinas is predicted to increase with additional subdivision and development.

Auckland has eight major marinas. These include four in the central Auckland area (Westhaven/Viaduct) and others at Bayswater, Gulf Harbour, Pine Harbour (Beachlands) and Half Moon Bay. Westhaven Marina is reputedly the largest in the southern hemisphere.

Marinas and moorings are sources of disturbance from human activities (e.g. potential input of industrial wastewater and stormwater runoff that can be contaminated by toxic chemicals, particularly oil, organochlorines and various heavy metals). Marinas are commonly sources of heavy metals. Copper, mercury and tin have been used in antifouling paints; chromium, lead and zinc in hull primers and marine paints; cadmium in paint pigments, and zinc is found in sacrificial anodes to reduce corrosion of immersed metal parts.

Dredging, extraction, land reclamation and disposal

Land reclamation and drainage activities are often undertaken to increase the area of useable land or to improve access to the coast. However, land reclamation can have adverse environmental effects such as the loss of coastal habitats and ecosystems, degradation or loss of natural character, changes in sedimentation processes and impacts on historic heritage.

Dredging, which is often required for the development and maintenance of facilities such as marinas and navigational channels, also has the potential to cause or exacerbate coastal erosion, disturb or destroy habitats and smother organisms on the seabed with sediment, and impact on amenity values.

Sand extraction for use by the construction industry and for replenishment of Auckland beaches (such as those at Mission Bay and Point Chevalier) is another activity that occurs on the seabed. Large-scale sand extraction can adversely impact nearby beaches that rely on offshore sand for natural replenishment. (Table 10).

TABLE 9 Type and number of coastal structures consented or under application, December 2008. (Source: ARC).

	Steps	Jetty/wharf/pontoon	Boatshed/dinghy locker	Boardwalk	Breakwater/groyne	Seawall/bank protection	Pipeline cable	Slipway/ramp	Mooring piles	Culvert/outfall	Grid	Bridge	Other	**Totals**
Existing	128	134	37	27	20	383	27	310	9	114	3	81	54	**1,327**
New	22	31	3	24	4	34	24	16	3	41	0	18	44	**264**
Total	**150**	**165**	**40**	**51**	**24**	**417**	**51**	**326**	**12**	**155**	**3**	**99**	**98**	**1,591**

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Pressures: consumption and production

TABLE 10 Current resource consents and applications for disposal, dredging, extraction and land reclamation, 2009. (Source: ARC).

Activity	Current consents	Current applications
Disposal/Deposit/ Replenishment	27	1
Dredging	32	3
Extraction	9	1
Land reclamation	47	9

Aquaculture

Aquaculture has the potential to provide significant economic benefits, but it can also place pressure on the environment as well as commercial and recreational activities and amenity values within the Coastal Marine Area (CMA). Potential environmental effects include modification of the water column and seabed habitats (with associated positive or negative consequences for marine plants and animals), promoting the growth of marine algae, and biosecurity risks.

Other effects include the impact on the seascape and visual amenity values from the marine farming structures and operations, the impact on activities such as recreational boating and fishing from the occupation of the CMA, and the impact of habitat displacement on marine mammals.

In 1998, there were 69 marine farms within the Auckland region that covered about 265 hectares. By 2008 this had increased to 70 farms covering about 341 hectares, principally due to the 76 hectare biomarine oyster farm in the Kaipara Harbour that was approved recently under transitional provisions of the Government's aquaculture law reforms. The ARC currently has 51 applications for marine farms that date back to 2001 or before. Processing of these applications remains on hold until the regional plan provisions for aquaculture are finalised.

This situation reflects a combination of the 1984 moratorium across much of the Hauraki Gulf that was imposed by the Ministry of Fisheries, a national three year moratorium between 2001 and 2004 that was imposed by the Government and complexities of the subsequent aquaculture law reform that came into force in 2005.

Implications of land use, land use change intensification and seabed use

The move towards a dense urban form has some environmental benefits because it facilitates efficient transport solutions and avoids the need to convert more rural land to urban use. This avoids development on productive soil and maintains the soil's ability to produce food. It also reduces pressure on the remaining soil resources, which might otherwise need to be used more intensively, leading to degradation.

However, urban intensification also has some negative environmental consequences as it concentrates other pressures. It can lead to a loss of open space and Significant Natural Areas (SNAs) within the urban area and can adversely affect the quality and amenity values of the urban environment and historic heritage. Large amounts of impervious surfaces can also reduce the water quality and ecological quality of urban streams (see Urban Stream Syndrome Case Study on page 86).

Changes in horticultural land use are likely to have some environmental implications, particularly sediment generation and possible declines in soil quality from continuous cultivation. Large-scale greenhouses that grow crops hydroponically or in special growing media also place a range of pressures on the soil, rural amenity values and water quality (given the potential for nutrient-rich discharges).

As with urban intensification, the implications of rural residential growth are complex. On the negative side, rural residential development can create adverse effects on the environment by changing its character and by requiring people to travel longer distances to employment, education and social activities. Fragmentation of rural land into smaller holdings parcels tends to reduce the economic viability of agricultural activities. In addition, increasing the number of land parcels above aquifers may lead to increased pressure on water resources.

On the positive side, changes in land use wherever rural residential development occurs can reduce the pressures that are commonly associated with agricultural production. For example, reduced amounts of nutrients that are discharged to the land through fertilizers and agricultural sprays, and retirement of land that is susceptible to erosion. It can also mean increased investment in riparian fencing and revegetation, leading to potential improvements in the water quality of rural streams and enhanced amenity values.

Pressures: consumption and production

Water use

Key findings

- Consent holders used 111 million m^3 of water in 2007/08. This is more than the 98 million m^3 used in 2002 but less than the annual volumes used between 2003 and 2005.
- Surface water from reservoirs in the Hunua and Waitakere Ranges provides the majority of water (by volume) used in the Auckland region.
- Applications for groundwater bores for domestic and stock use have increased over recent years. This is likely to reflect ongoing rural subdivision in areas where there is high demand for groundwater.

Introduction

Water is one of the most valuable natural assets and plays a critical role in supporting life and ecosystems. It provides a wide variety of aquatic habitats and important ecosystem services, such as nutrient processing and cycling, climate regulation, and the transportation and dilution of waste.

Water bodies are highly valued in the Auckland region and are used for a variety of recreational activities, including swimming and kayaking. Local iwi have strong historical and spiritual links to many water bodies and streams. The demand for water can place pressure on all these values.

Water is taken from groundwater (aquifers) or from surface water (streams, lakes and dams) to meet the needs of domestic, primary production, commercial and industrial users.

When water is taken out of a stream the flow is reduced which, in turn, may impact the ecology and habitat downstream. The impact of taking groundwater is less obvious but can result in lowered water levels in streams, lakes and wetlands and seawater contamination of the aquifer.

The damming of rivers and the taking of water from them can increase the frequency and duration of low flows, change flow variability, degrade water quality, and reduce instream habitat. There are estimated to be 4,500 dams in the Auckland region; many unauthorised. The cumulative effects of these dams may be substantial, particularly in catchments with many small rivers.

In the Auckland region, the greatest demand is for municipal supply. Watercare Services Ltd, Auckland's largest bulk water provider, supplies about 375,000 m^3 each day. Most of the water comes from supply dams in the Hunua and Waitakere Ranges but some additional water is sourced from outside the Auckland region.

Monitoring water use

The ARC monitors groundwater levels and river flows as part of its long-term baseline programme. Resource consent holders are required to record their water use and submit water use returns to the ARC. Collectively, this data is used to ensure that water use is not causing adverse effects on the environment. If it is, the council can take action to address the problem. Water allocation, use and monitoring data are published annually in the ARC's Water Quantity Statement series.

Major sources of water demand

Indicator 14: Water allocation by sector

During the year ending June 2008, 147 million m^3 of water was allocated by resource consent and approximately 111 million m^3 (76 per cent) was taken by consent holders.

Table 11 shows that, of the water allocated, the major use is municipal supply. Watercare Services Ltd has consents to take up to 88 per cent of the total water allocated within the Auckland region for this purpose, while Franklin District Council takes 2 per cent of total water allocated and Rodney District Council takes 1 per cent.

Irrigation (hothouses, nurseries, pastoral, orchards and market gardening) is the second highest water allocation and use within the Auckland region, followed by industry (for example, piggeries, vegetable washing, poultry farms, industrial use, and cooling/circulation).

It is important to note that water is also taken by users, particularly in rural areas, as a permitted activity. This volume is not included in Table 11.

TABLE 11 Water allocation and use (millions m^3) by sector, 2007-08. (Source: ARC Consents data).

	Municipal	Irrigation	Industry	Community	Other	**Total**
Allocation	109	13	12	7	6	**147**
Use	98	5	5	2	1	**111**