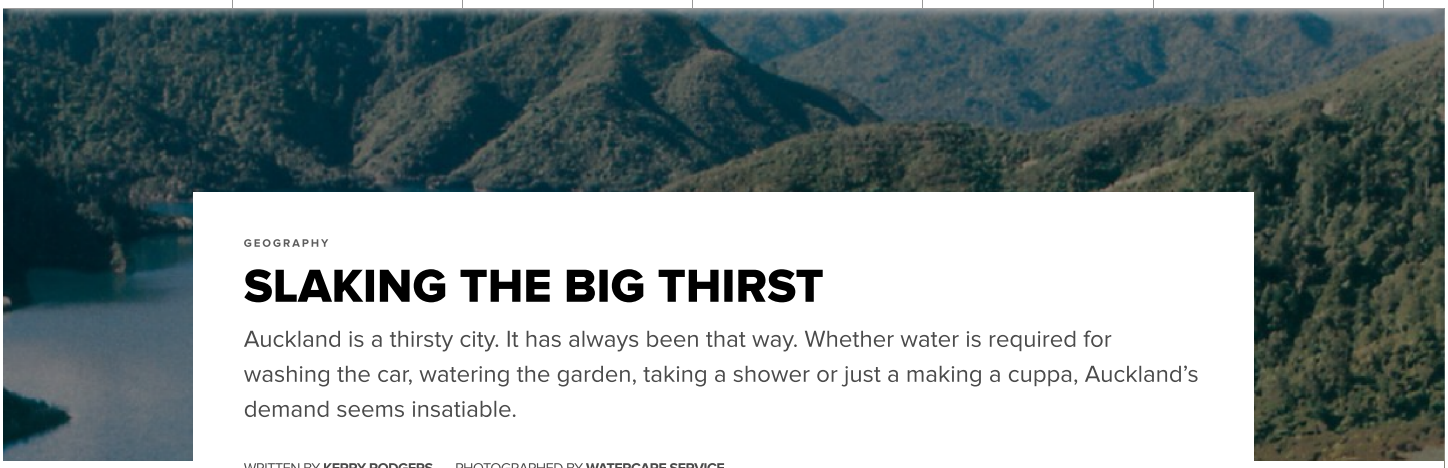


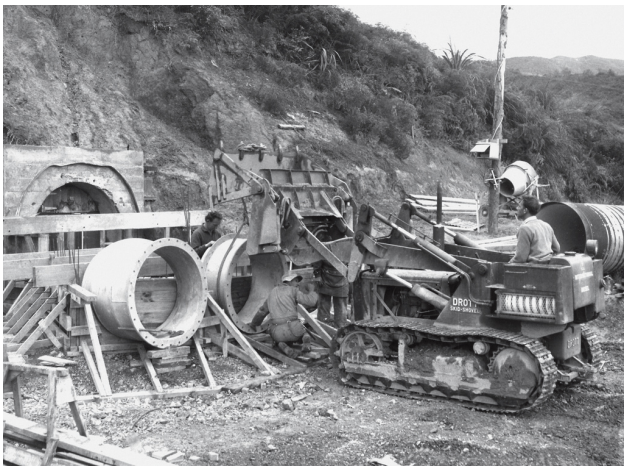
GEOGRAPHY

SLAKING THE BIG THIRST

Auckland is a thirsty city. It has always been that way. Whether water is required for washing the car, watering the garden, taking a shower or just a making a cuppa, Auckland's demand seems insatiable.

WRITTEN BY **KERRY RODGERS** PHOTOGRAPHED BY **WATERCARE SERVICE**

THE ENTIRE PLAN came under intense criticism from the moment the public became aware of it—as all public-watersupply projects tend to do. A royal commission was empanelled in 1927 and a comprehensive reappraisal conducted with the aid of overseas consultants. However, the strategy was vindicated in its entirety and the local engineers were deemed to have got it right.



A major strength of the plan lay in its flexibility. In 1902 both engineers and politicians recognised that different parts of the metropolitan area would develop at different rates and that from time to time the development of the water supply would need to be tweaked to cater for population explosions in particular areas. The first such increase in population occurred in the west; subsequent growth took place in the east and south.

Today, the Hunua reservoirs supply over 60 per cent of greater Auckland's water. In 2006, the first of these to be built, at Cosseys Creek, turned 50. Its dam has just had a full refurbishment. It seems an appropriate time to take stock of an essential part of Auckland's infrastructure and to acknowledge the contribution those far-sighted planners made in 1902 to the many conveniences Aucklanders today take for granted, such as the ability to espress a cappuccino or flush the toilet.

Before 1902, Auckland's water supply had developed on an ad hoc basis. In its first 26 years, the new settlement depended on rain-filling tanks and wells of varying and dubious quality. There were no reliable streams in the vicinity. The notorious Ligar Canal, which ran the length of what has become Queen Street, was sluggish and fouled. Betterthan-normal water for the Albert Barracks came from a well on the Albert Park volcano.

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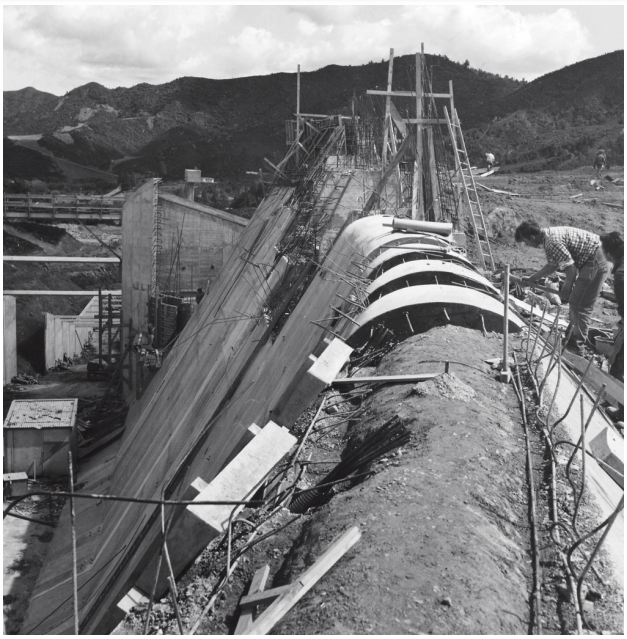

In 1871 Auckland was promoted from borough to city. From then until the Auckland Regional Authority took over in 1965, the city council had responsibility for supplying bulk water to the majority of territorial authorities in the metropolitan region. Back in the 1870s, however, private enterprise was alive and well, with Seecombes Well in Khyber Pass providing the new city with a steady supply of water from an aquifer below Mount Eden at two shillings per 1000 gallons.

The first of Auckland's interminable water debates soon erupted. It concerned the relative merits of the Waitakeres, the Hunuas and the Waikato River as sources of water for the city. In the event, the council ignored all three options and decided instead to tap Western Springs, where a free-flowing spring emerged from beneath the Three Kings lava flow. This source was nearer and therefore cheaper to draw on than any of the others. In 1877 the spring was dammed and a steam-driven beam-engine pump installed to pipe the water to a reservoir in Ponsonby 72 m higher than its starting point. This scheme brought the installation of the triple-pressure zone system that still services the central isthmus: from Ponsonby, water was pumped up to the Khyber Pass reservoir, and from there higher still to the reservoir on Mt Eden.

Over the next 22 years, as Auckland's population increased from 18,000 to 50,000, Western Springs was almost the city's only source of water, supplying about 65,000 m^3 a day. However, by 1899 the aquifer was clearly unequal to growing demand, and additional water had to be pumped from Cantys (Oratia) Creek, in Henderson. A major new supply was urgently required.

*

THE FIRST WATER for metropolitan use from the Waitakeres proper was taken in 1902. This was an emergency supply drawn from two timbered intakes on the Nihotupu Stream and Quinn's Creek and pumped 12.5 km through a cast-iron pipe to a holding tank in Titirangi. From here it was fed by gravity to Western Springs.

It was then that the long-term water-supply strategy was adopted by Auckland City Council. We can count ourselves blessed today that the politicians of the time recognised that ad hoc systems and small-scale solutions would never support the demands of an expanding metropolitan area. At no time during Auckland's first 60 years of growth had its water supplies been adequate, so even the immediate future looked problematic.

The water situation in 1902 was not unlike that which society faces today in respect of its energy demands. The politicians who grasped the nettle were supported in their endeavours by a succession of superb, locally trained engineers who understood the problem and had a ready solution. The first phase would be development of the Waitakere catchment.

Work commenced on the first Waitakere dam, situated on the Waitakere Stream itself, in 1906. It was completed in November 1910, although its supply was tapped as early as 1907 via a temporary timber intake, as noted above.


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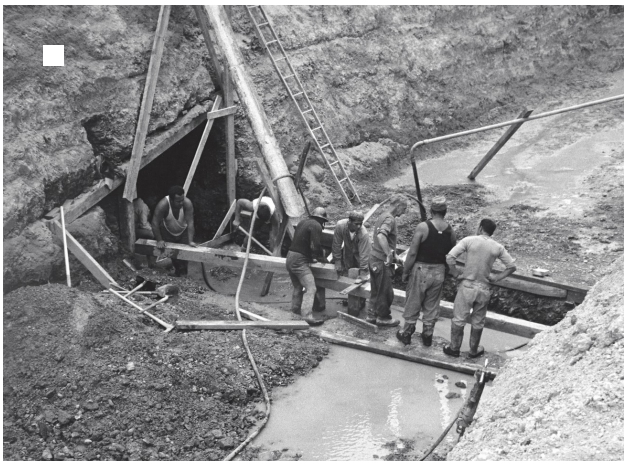
exceptionally heavy rain saved the situation. As a result, work at Lower Nihotupu started that year, with its supply becoming available in 1948.



Further development in the Waitakeres was now postponed, as the rapid expansion of the Auckland metropolitan area required that work commence on developing the much larger and more cost-effective Hunua resource. A decade-and-a-half later, however, rapid post-war growth in west Auckland led to the construction of one more Waitakere dam—the largest, at Lower Huia—completed in 1965.

The Hunua Ranges are a fine site for a water-supply catchment. Like the Waitakeres, they enjoy high rainfall, receiving about 1.5 times the amount that falls on the Auckland isthmus, and their height means water can flow to the city under gravity, with little or no pumping.

Cosseys Creek, named after the valley's first European resident, Solomon Cossey, was the nearest source in the catchment to Auckland. Work commenced here in 1946 but wartime shortages delayed development. In 1953 the stream flow itself was tapped and 5.6 km of tunnel aqueduct and 24 km of pipe were laid, although post-war shortages meant the pipe diameters were less than ideal. The dam proper was started in 1951 and came onstream in 1955, making a further 64,000 m^3 of water a day available for the metropolitan area. For the first time in years, Auckland had adequate water-storage capacity. It was the first time since before the war that supply exceeded demand.

But Auckland continued to grow apace. The region had held 160,000 people in 1941, but by 1954 the population exceeded 320,000 and was growing faster than ever. In the first instance, the mains capacity from Hunua needed to be doubled to allow the full capacity of the Cosseys Creek supply to be tapped. Next, a series of tunnels were driven through the Hunuas to allow the water captured from other streams to be piped to a new filter station at Ardmore.

First cab off the rank was the 1392 m Wairoa tunnel, from the Hunua Valley to the Otau Valley. This was completed in 1956 and allowed the full capacity of the first stage of the Wairoa dam to be utilised when it was completed in 1960. This was followed in 1961 by the 2884 m Mangatawhiri tunnel, between the Otau and Moumoukai valleys.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A survey of the catchment in the 1930s had led to Mangatawhiri Stream in the Moumoukai Valley being discounted as a major water source. However, a re-survey of the entire Hunua catchment in 1959–60 showed that a good gravity supply could be obtained from a potential dam site on the Mangatawhiri 96 m higher than the Khyber Pass reservoir. Priority was given to developing this site in favour of continuing work at Wairoa. The new reservoir was commissioned in 1965, adding 66,000 m^3 a day to the city's water supply.

This change of plans led to a redesign of the Hunua system. It had been intended to dam the lower reaches of the Mangatawhiri Stream and add to the supply from there via a new main line. Instead, these waters were now impounded at Achesons and Milnes Creeks and pumped into the upper reservoir. This required increasing the capacity of the tunnel aqueducts from the Mangatwhiri to the Ardmore Filter Station from 245,000 m^3 to 390,000 m^3 a day.

In 1968 the first stage of the Mangatangi project was completed, the largest of Auckland's upland catchments. It is capable of supplying 100,000 m^3 a day, via 10 km of tunnel and aqueduct. A year earlier, Papakura township had commissioned Hays Creek Dam, built in the Hunua Gorge. This is the smallest of the Hunua dams and was designed solely to supply water to Papakura. It has since been incorporated into the wider Hunua system.

The last step in the 1902 planners' vision was the linking of the Waikato River into the Auckland water-supply system. This occurred in 2002, after the near-disastrous drought of 1994 demonstrated that rainfall could no longer be relied on to keep the dam lakes full. The river had been gazetted for public water supply in 1963, when the Water Pollution Regulations were enacted.

With the amalgamation of the numerous territorial authorities of the greater Auckland area into five local bodies in 1965, the Auckland Regional Authority took over responsibility for bulk-water supply to the region from Auckland City Council. At this stage Auckland was consuming some 47 per cent of the total water supplied each day. Today the entire system is managed by Watercare Services, which also disposes of the region's waste water.

*

THE EARLY WAITAKERE DAMS are concrete-arch structures. In contrast, the later Waitakere dams and all the Hunua dams are earth dams—or, in engineers' parlance, earth-core rock-shoulder dams—and are built from materials available on site.

Essentially, an earth dam consists of successive layers of compacted earth, with a core made from the most impervious material available, such as clay. Stronger materials, like rock, are then placed on the upstream and downstream sides of the core to strengthen it. Hence the term "earth-core rock-shoulder".

In the Hunuas, materials for building earth dams are available in abundance. The local bedrock is greywacke, which is hard and strong and has a deep, clay-rich weathering profile, making it ideal core material but impossible to work during winter and spring. Construction at Cosseys Creek took three summer seasons, during which 411,250 m of clay and rock were placed at a point where the stream valley is deeply incised across an ancient fault scarp. Compacting was carried out with sheep-foot and pneumatictyred rollers up to 50 t in weight. All earth dams need to be built on a solid, water-tight foundation to prevent water loss through seepage from underneath or, worse, the undermining of the whole structure. The basement greywacke on which the Hunua dams are built is highly fractured, and hence potentially porous. After clearing the bedrock on which each Hunua dam was to be built, a systematic

All dams have spillways for getting rid of excess water as a precaution against catastrophic washout. At Cosseys Creek the original plan was to construct a conventional concrete-channel spillway on the northern side of the dam. When the site was cleared, however, it was found that an ancient tributary valley running into the creek at that point was full of soft pumice-rich sediments that would have made an unsuitable foundation for this kind of spillway. Consequently, a more expensive bell-mouth spillway had to be built instead.

Each Hunua earth dam is protected from wave and rain erosion by large, carefully placed stones, known as rip-rap, on the upstream face. The downstream buttress is grassed and continuously monitored for signs of seepage.

The Mangatangi dam, commissioned in 1977, is the second-largest earth-core rock-shoulder dam in the country. Its lake, covering 185 ha and containing 35,000,000 m^3 of water, is New Zealand's largest metropolitan reservoir.

*

AUCKLAND ENDOWED THE REGION with a major conservation area. When Auckland Regional Authority took over the bulk water supply from the city council in 1965, the 17,000 ha of steep and rugged bush country that constitute the Hunua water catchment became Hunua Regional Park. Its highest point is Kohukohonui trig, at 688 m.

Few permanent pre-European settlements are known in this area, although the Hunua forest provided Maori with food, timber and refuge. In the wake of the Land Wars, Europeans moved in, Solomon Cossey among them. Timber was felled for export and local construction, and the bush was cleared to make way for farms. However, the difficult nature of the terrain, limited access and poor soils made the region one of the least desirable for settlement once the timber had gone. Auckland city began to purchase the more remote and rugged parts of the ranges as a potential water-supply catchment in the 1920s.

Today, conservation is the main aim of managing the park. The park contains the largest remaining block of rain forest in the Auckland region, and the areas in which kauri, matai, kahikatea, tawa, rata and rimu were logged in the 19th and 20th centuries are all regenerating, as is the bush throughout the catchment.

Today, common Hunua native birds include korimako (bellbird), kāhu (Australasian harrier), riroriro (grey warbler), kotare (kingfisher), kereru (New Zealand pigeon), welcome swallow, tui, piwakawaka (fantail), tauhou (silver-eye), miromiro (tomtit) and pipiwharauroa (shining cuckoo). Less common are kaka, koekoea (long-tailed cuckoo) and toutouwai (North Island robin).

Of particular note is the kokako recovery programme. Hunua Regional Park contains the last remaining original kokako population in the Auckland area. By 1994 this stood at 25 males and one female. The possums, goats, rodents and stoats that were threatening these survivors were targeted by an intensive poisoning and trapping programme. Since February 2004, nine kokako pairs have been breeding in an area of 800 ha criss-crossed by a grid of possum-and rat-bait stations and surrounded by a Berlin Wall of stoat-and ferret-trap lines.

These measures have led to a sharp upturn in the Hochstetter's frog population in the kokako recovery area. A survey by the regional authority in 2003 revealed an abundance of juvenile and young frogs compared with similar surveys carried out in the mid-1990s. Its findings also indicated that the structure and health of the Hunua population were as good as, if not better than, those of other North Island populations.

The reduction in alien predators has also resulted in the return of, or an increase in, populations of such birds as North Island robin, bellbird and kaka. In April 2003, 40 pairs of whiteheads were released, marking the species' return to the Hunuas after an absence of 120 years. If the whiteheads flourish, long-tailed cuckoos, which favour whitehead nests, should also increase in number.

For humans, Hunua Regional Park provides for a range of recreational activities, including walking, tramping, camping, mountain-biking and even trout-fishing. Aucklanders owe a deep debt to those 1902 local-body politicians and engineers who conceived the place.

More by Kerry Rodgers

More by Watercare Service

FACT FILE

Between them, Watercare Service's 10 reservoirs can hold up to 96,000,000 m^3 of water. Each day about 350,000 m^3 is supplied to the Auckland metropolitan area. Approximately 60 per cent comes from the five Hunua dams, 25 per cent from the five Waitakere dams, 10 per cent from the Waikato River, and 5 per cent from an underground source in Onehunga.

Dams don't simply store water. Like wine, water held in a reservoir improves in quality

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