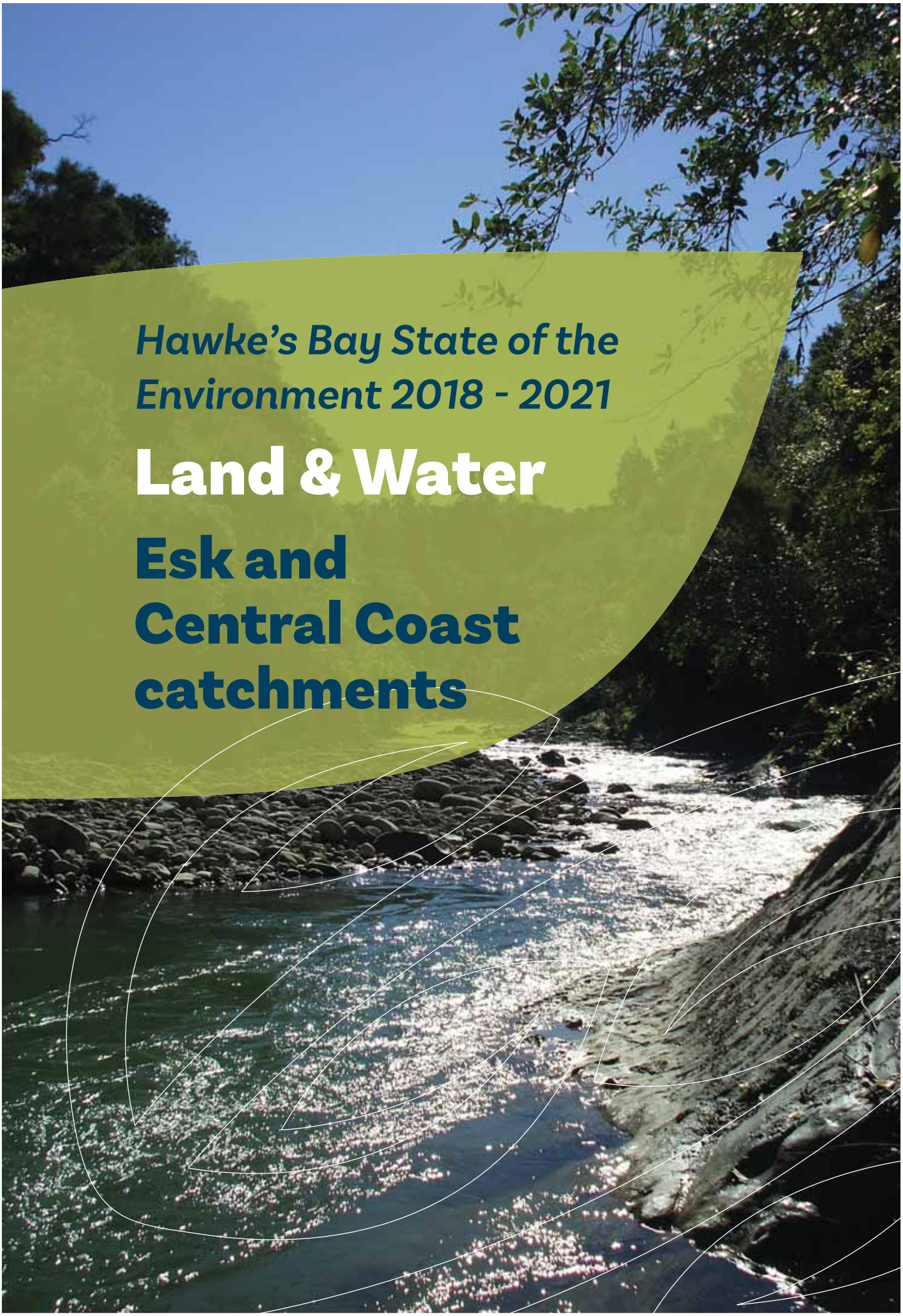


Hawke's Bay State of the Environment 2018 - 2021

Land & Water

Esk and Central Coast catchments

17. Esk and Central Coast catchments

Draining east from the bush-clad Maungaharuru Range, the Waikare, Aropaoanui, and Esk (Te Wai o Hinganga) Rivers are medium-sized, tree-lined rivers that flow through steep gorges in their upper catchments and flatten out closer to the coast. Smaller catchments like the Waipatiki, Te Ngarue, and Pakuratahi tumble out of the steep coastal hill country. Lakes in the catchments were formed by landslides, including Tūtira, Waikōpiro, Opouahi, and Orakai.

Waterways such as the Esk and Aropaoanui Rivers and the wetlands and streams around Tūtira were highly prized by tāngata whenua for mahinga kai, especially tuna. Today, people fish for whitebait, flounder, mullet and tuna in the Esk, Aropaoanui, and Waikare Rivers, while trout fishing is popular on Lake Tūtira and in the Esk River. Swimming is popular in the Esk River and at Waipatiki Beach.

Key points:

- Sheep and beef farming is the dominant land use in the catchment, and production forestry also covers a relatively large proportion of land, particularly in the steeper parts.
- Recent periods of low rainfall have contributed to lower-than-average river flows.
- Elevated *Escherichia coli (E. coli)* may be compromising swimmability in many waterways.
- Dissolved reactive phosphorous (DRP) is high at all sites.
- Sedimentation is likely to be impacting aquatic fish and bugs.
- The streams in the catchment support populations of regionally rare native fish.
- The four lakes in the catchment that are monitored have differing issues and challenges. Problematic algal blooms in Tūtira have not occurred for the last three years, making it more suitable for swimming than in the past.

Land Cover

The Esk and Waikare catchments are covered in indigenous forest in the upper reaches, and the steep and rolling hill country around the lower reaches has a mixture of extensive sheep and beef farms, production pine forestry, and a few dairy and deer farms. Vineyards and orchards line the flatter slopes of the Esk Valley (Figure 17-1). From 2001-2018, the only noticeable land-use change has been a slight increase in production forestry, which was converted from grassland (Figure 17-2).

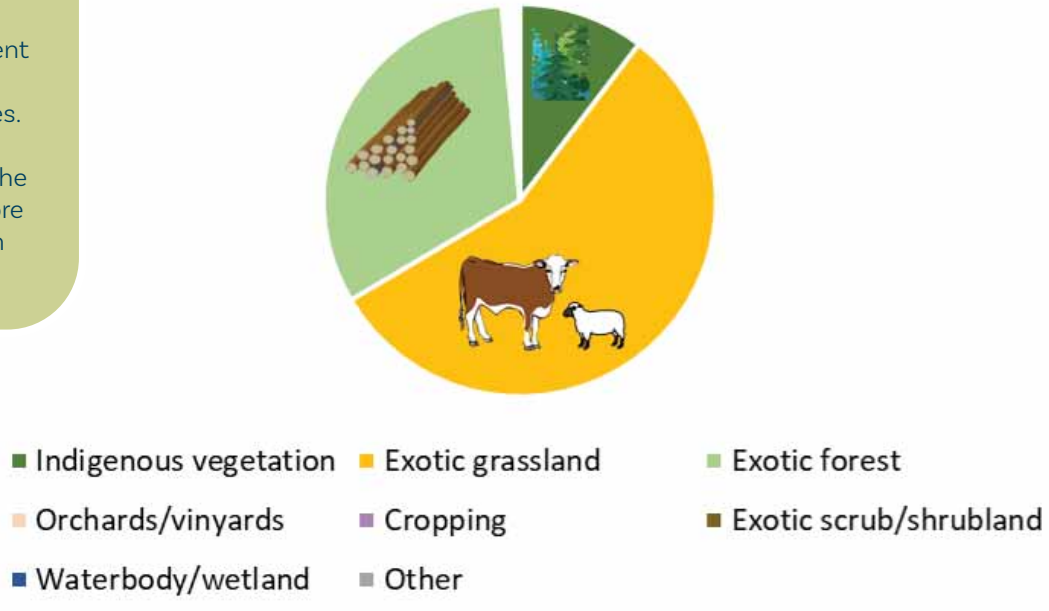


Figure 17-1. Land cover in the Esk and Central Coast catchments. The 'other' category includes built-up areas (settlements, urban parkland, and transport infrastructure) and bare surfaces such as bare soil, gravel, and rock.

Erosion processes are very active in this catchment and generate an average sediment yield of 682 tonnes/km^2 per year.

The primary soil types in these catchments are pumice soils and brown soils, which cover about 40% and 37% of this area respectively. Pumice soils have low soil strength, low clay content and low reserves of major nutrients. Brown soils develop under a humid environment and have moderate to low levels of soil fertility. Allophanic soils, which have high phosphate retention but usually low fertility, occupy around 9% of land, mostly in the south.

Erosion processes are very active in these catchments and generate an average sediment yield of 682 tonnes/km^2 per year. This is comparable to the Wairoa, Nūhaka, and Mahia areas, which have a similar topography and land cover. The total annual sediment load from waterways in the catchments is around 666,000 tonnes per year, which is 9% of the load from all waterways in Hawke's Bay. The hillslope sediment load is estimated to have increased more than threefold since human occupation, as a result of forest clearance.

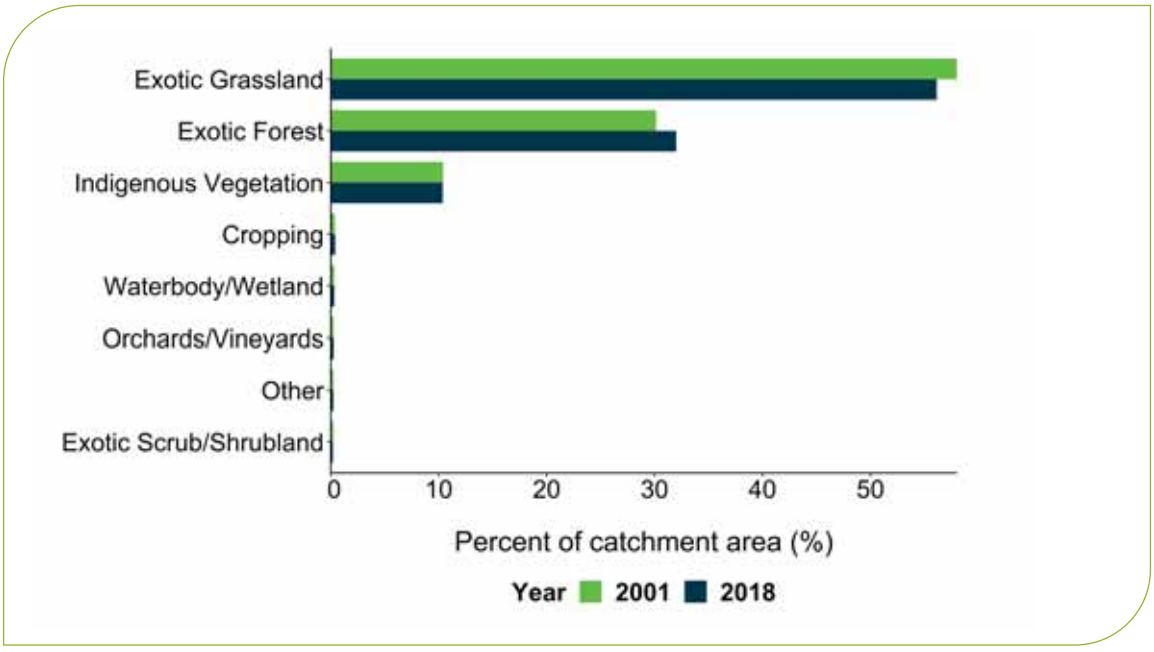


Figure 17-2. Land cover change for the Esk and Central Coast catchments (98,296ha) between 2001 and 2018. The 'other' category includes built-up areas (settlements, urban parkland, and transport infrastructure) and bare surfaces such as bare soil, gravel, and rock.

Climate

Annual rainfall across these catchments is typically less than in the neighbouring Mohaka area and greater than in the TANK catchments. This pattern was generally true from 2018-2021, but 2019-20 was an exception. The 2019 winter was drier here than elsewhere in the region (Figure 17-3) and combined with the summer and autumn drought that followed, it contributed to an annual rainfall below the long-term average and below the TANK catchments' rainfall. The 2020-21 drought was not as extreme as in southern parts of Hawke's Bay, apart from the Esk catchment, which bore the brunt of the area's dry summer weather (Figure 17-3). All three years had above average annual temperatures.

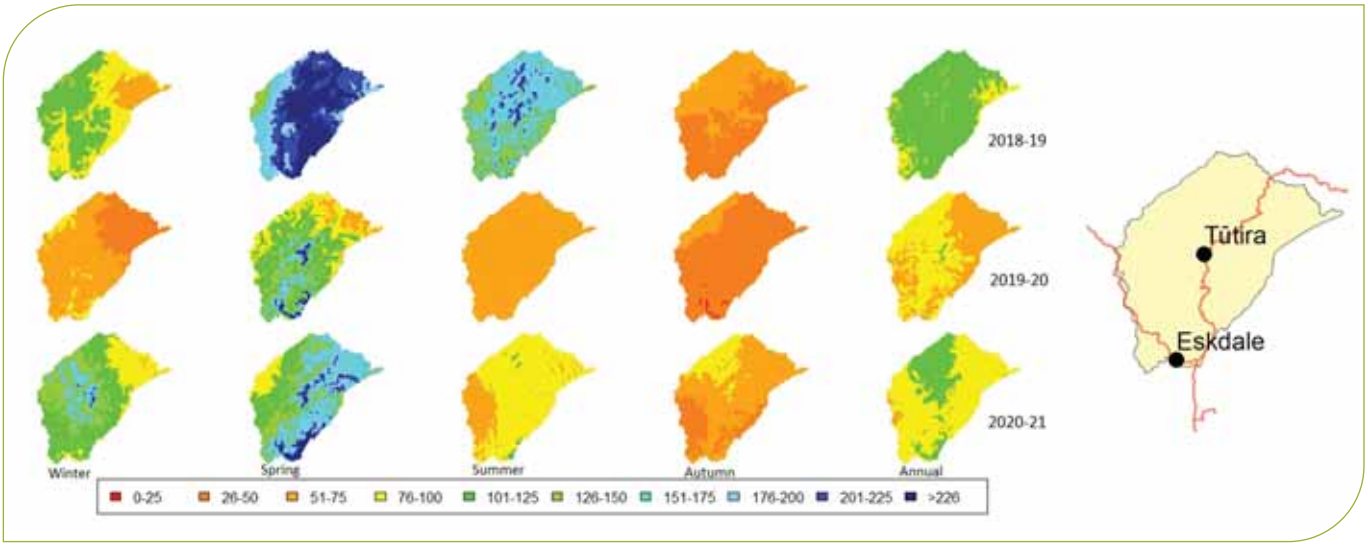
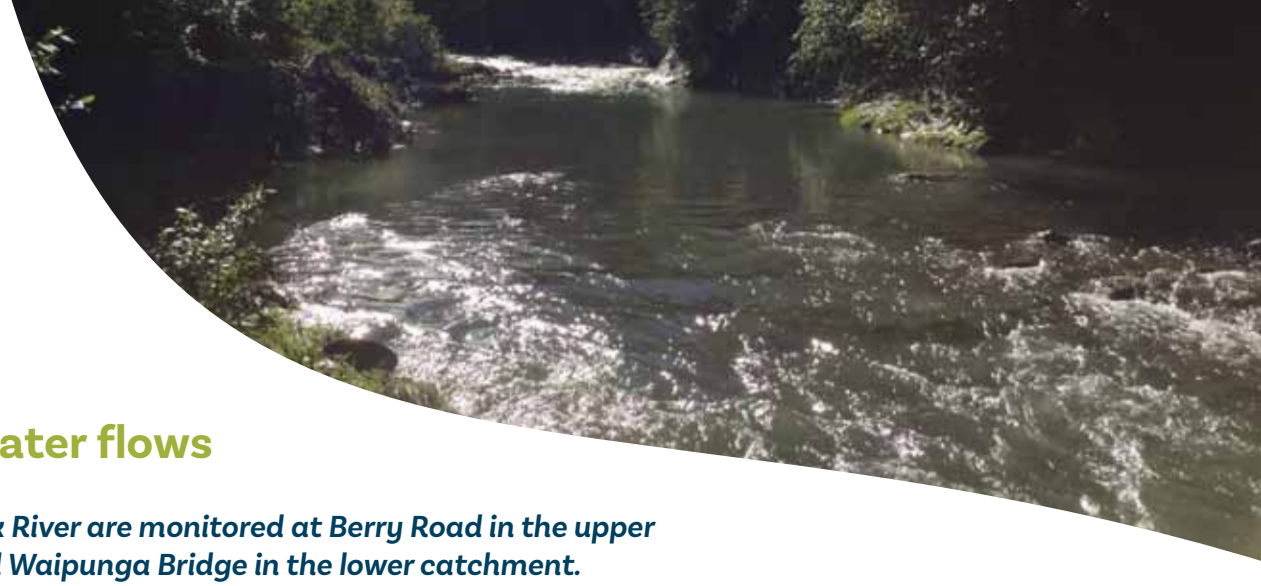


Figure 17-3. Seasonal and annual rainfall for 2018-2021, shown as a percentage of the long-term average.

Spring rainfall has increased over the last 25 years, as has the number of days with rainfall greater than 1mm. Maximum and minimum temperatures, and potential evapotranspiration rates also increased over the last 20 years.

Climate change modelling projects that temperatures will continue to warm, and potential evapotranspiration rates are expected to increase.

Annual rainfall is projected to decline approximately 3% by the end of the century, and spring rainfall is anticipated to decline by approximately 8%, counter to current trends. However, summer rainfall is predicted to increase by approximately 2%.



Surface water flows

Flows in the Esk River are monitored at Berry Road in the upper catchment and Waipunga Bridge in the lower catchment.

Data from both sites reflects the dry periods shown in Figure 17-3, with low annual minimum flows below the long-term average at Berry Road in 2018-19 and (Figure 17-4). Despite being in the same catchment, the two sites varied in the magnitude of low flows. For example, in 2019-20, the 7-day annual low flow was normal for Berry Road but well below normal for Waipunga Bridge. These variances are likely due to differences in localised rainfall between the upper and lower catchments. Long-term records for the Waipunga Bridge site show over the past 60 years, annual low flows appear to be getting lower.

The dry summer and autumn periods over these years also resulted in restrictions on consented surface water abstraction in the Waikari catchment.

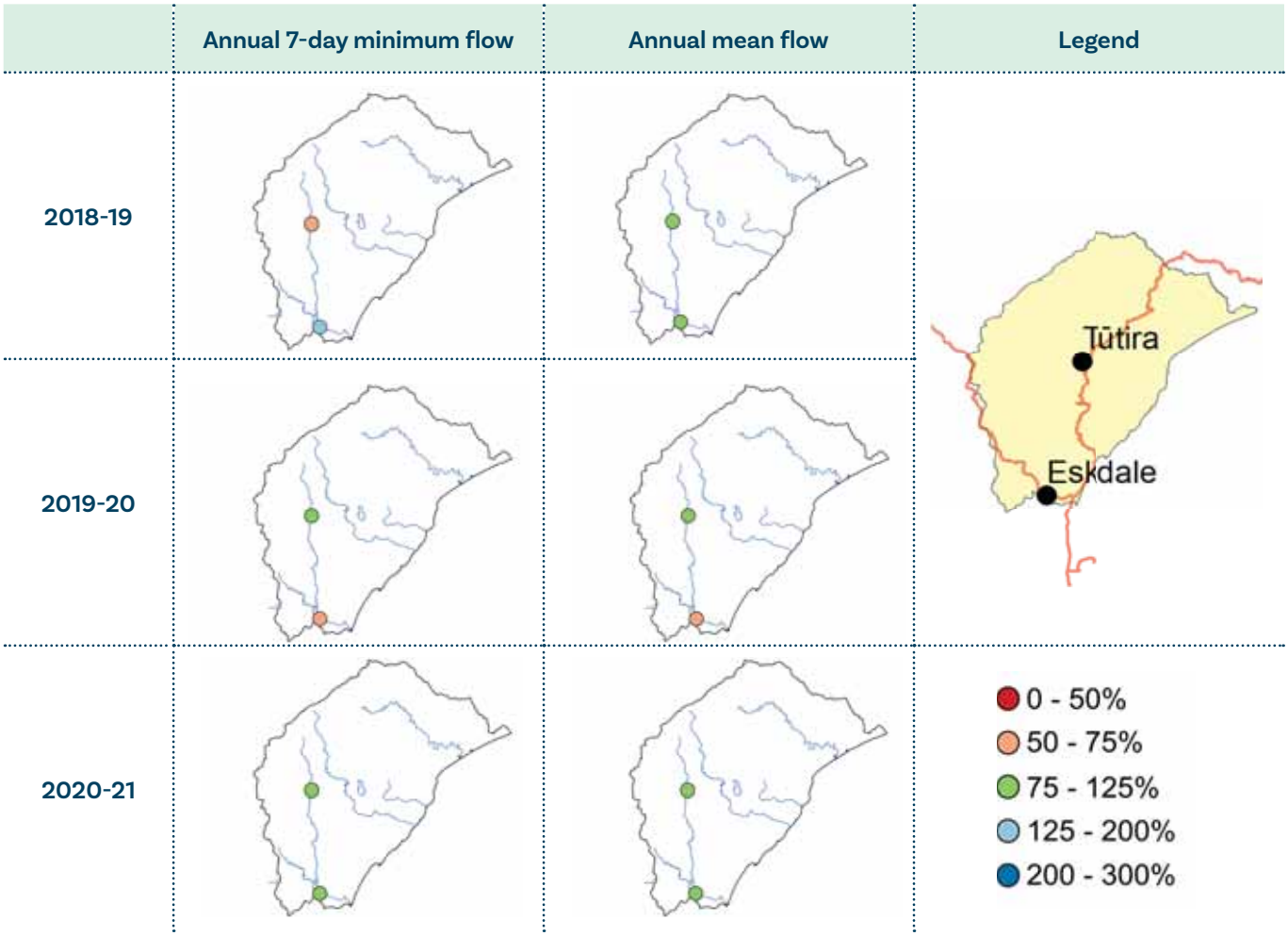


Figure 17-4. River flows shown as a percentage of the long-term average.

Groundwater quality

The Esk and Central Coast catchments have one groundwater monitoring site in the Esk Valley. The groundwater here is in a reduced (low oxygen) state, which can dissolve minerals in the material surrounding aquifers, releasing them into the groundwater and causing elevated iron, manganese, arsenic, and/or calcium carbonate (i.e., hardness). These minerals may compromise human health, affect the taste of drinking water, and clog irrigation systems.

The water quality at the monitoring well exceeds the Drinking Water Standards of New Zealand (DWSNZ) human health limits for manganese and arsenic. Elevated arsenic is a consequence of a naturally occurring interaction between groundwater and the surrounding rock material. Groundwater also exceeds irrigation guidelines for iron, manganese, and total hardness, and the DWSNZ aesthetic and taste guideline for hardness. The elevated levels of these elements in the groundwater are a natural reaction between the rock material and reduced oxygen state.

Groundwater in this catchment is low in nitrate-nitrogen (NO_3-N), yet relatively elevated in ammoniacal-nitrogen (NH_4-N) and dissolved reactive phosphorus (DRP). NH_4 is a reduced state of NO_3 caused by the reduced groundwater conditions at this location.

River water quality

Draining steep topography, the rivers and streams in these catchments have a moderate gradient with large river/stream bed material, high aesthetic values, and generally good water clarity. However, monitoring shows that deposited sediment may be impacting ecosystem health, with low macroinvertebrate community index (MCI) values at many sites (Figure 17-5). Dissolved reactive phosphorus (DRP) and Escherichia coli (E. coli) concentrations are also elevated.

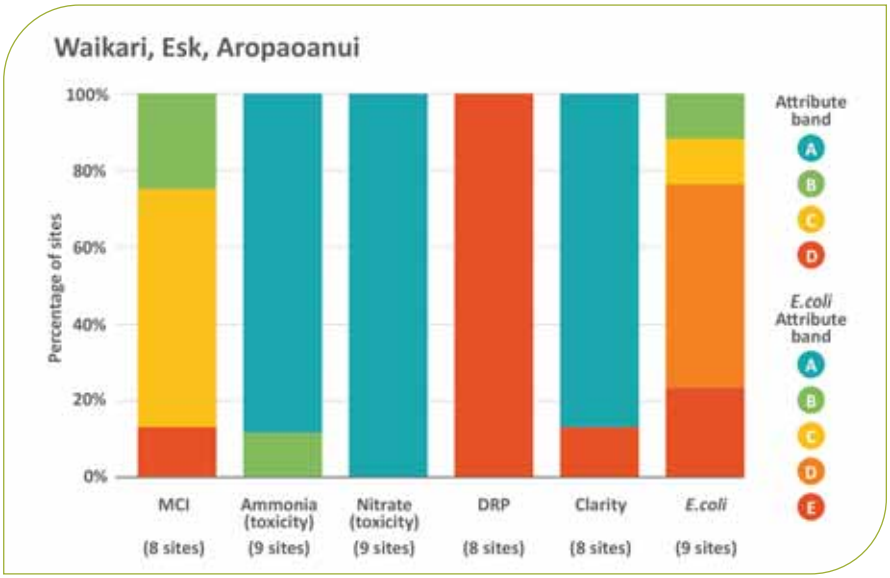


Figure 17-5. Bands (A = Good, D/E = Poor) in the National Policy Statement for Freshwater Management (NPS-FM) for river attributes in the Esk and Central Coast catchments. DRP = dissolved reactive phosphorus. MCI = macroinvertebrate community index. Grading based on latest five years of available data.

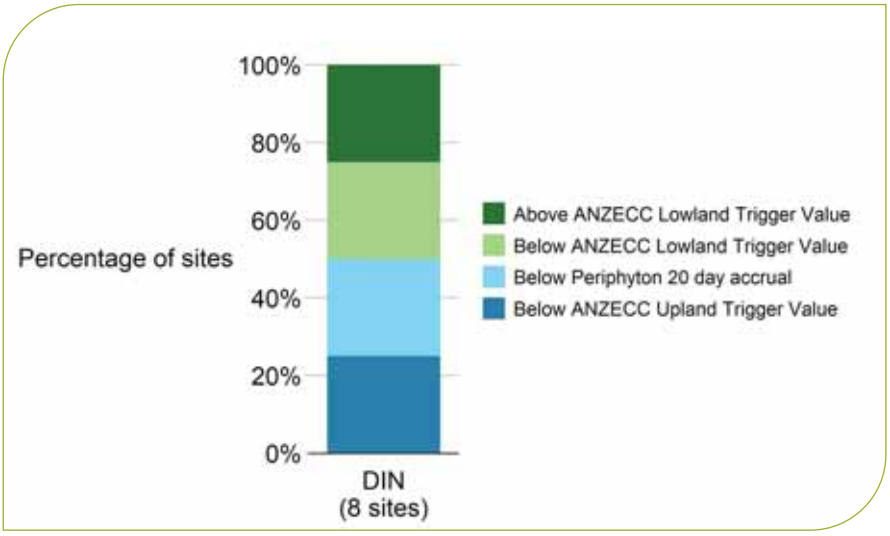


Figure 17-6: Median dissolved inorganic nitrogen (DIN) concentrations for sites in the Esk and Central Coast catchments, relative to ANZECC upland and lowland (2000) or Biggs (2000) periphyton trigger values.

All monitored sites in the catchments have high DRP concentrations (Figure 17-7), which can fuel nuisance periphyton growth in the mainstems of the Esk and Waikare Rivers. Phosphorus bound sediment contributes to the enrichment of DRP in these areas.

In addition to being a source of DRP, deposited sediment can also be a major stressor for aquatic fish and invertebrates, filling in nooks and crannies where these animals' dwell. MCI values across many sites are poor, reflecting degraded ecosystem health, which may be a result of sedimentation.

Faecal contamination of waterways is also an issue in the catchments, with six of eight monitored sites having elevated E. coli concentrations (Figure 17-5). Reduced sediment levels and E. coli would likely improve ecosystem health and swimmability in the catchments. Erosion control in critical source areas and excluding stock from riparian areas are likely to be effective options. In production forestry, the new National Environmental Standard (NES) for Production Forestry 2020 sets out stricter conditions on stages of a rotation cycle to reduce sediment loss.

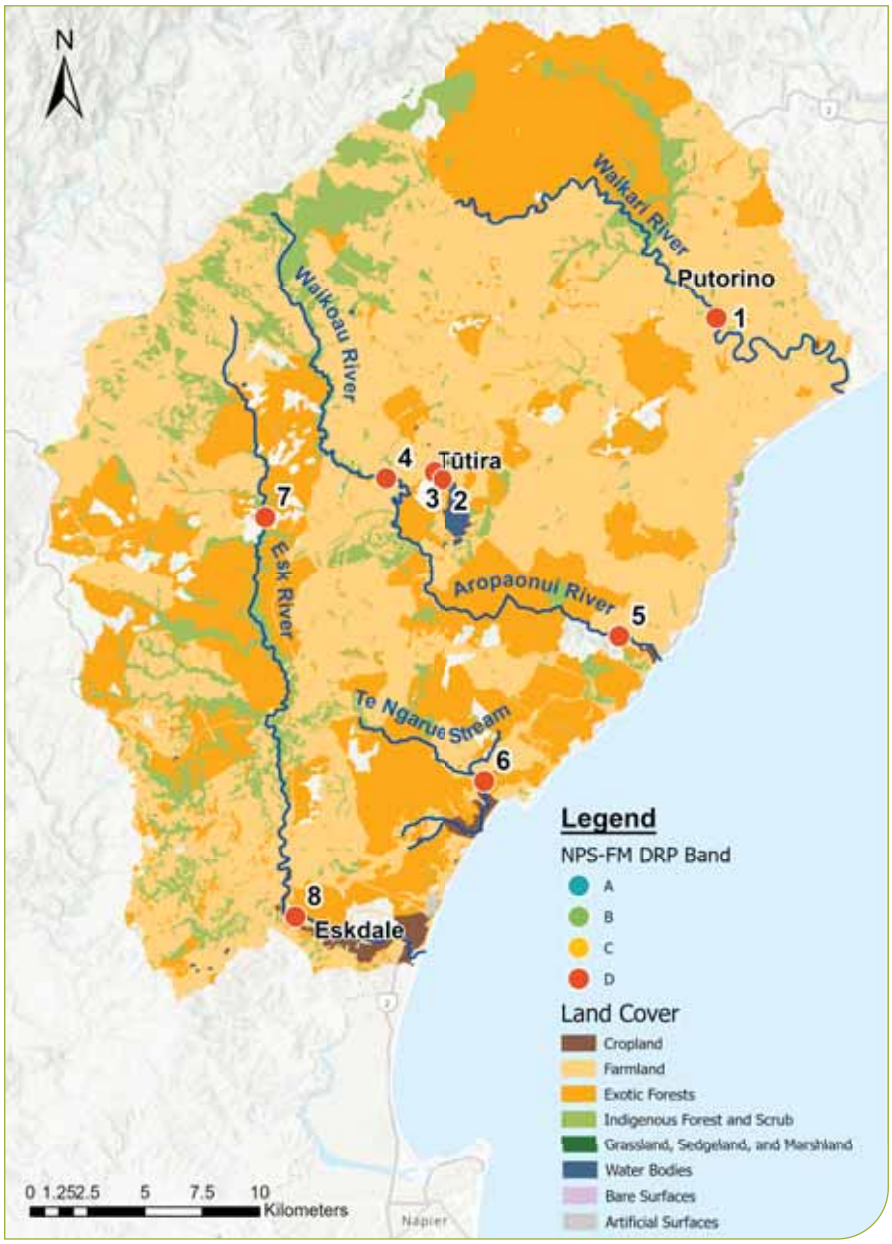


Figure 17-7. Dissolved Reactive Phosphorus (DRP) bands and land cover in the Esk and Central Coast catchments . 1. Waikari River at Putorino, 2. Papikiri Stream at Gauging Station, 3. Mahiaruhe Stream d/s Tūtira, 4. Waikoau River at Waikoau Rd, 5. Aropaonui River at Sideless Bridge, 6. Te Ngarue Stream d/s Kotomangeni, 7. Esk River at Berry Rd, 8. Esk River at Waipunga Bridge.

Fish populations in streams

In summer 2020-21, native fish surveys were conducted in streams around Lake Tūtira and the Waipatiki catchment. The surveys found healthy populations of banded kokopu (Figure 17-8), which are uncommon elsewhere in Hawke's Bay.

Banded kokopu are one of the five galaxiid species in the whitebait family. The juvenile stage can climb waterfalls, and they can grow up to 25cm long. They prefer small steep streams with lots of tree cover – a habitat type that is rare in Hawke's Bay because of historical land clearance. HBRC is currently co-funding fencing and planting to provide riparian tree cover over streams with kokopu populations.

Figure 17-8. An adult banded kokopu.

Figure 17-9. The Tūtira lakes. Orakai (top left), Waikōpiro (bottom left) and Tūtira (right - photo by Peter Scott www.abovehawkesbay.co.nz)

Lake water quality

Lake Tūtira is the largest lake in the catchment, followed by Waikōpiro, Opouahi, and Orakai (Figure 17-9). The popular Tūtira, Waikōpiro, and Opouahi have high recreation and amenity values, but also a history of enrichment and nuisance algal blooms that have often made them unsuitable for contact recreation.

The ecology of lakes is complex. Algal blooms are dynamic and difficult to predict, often fuelled by legacy nutrients that entered the lake decades ago. These nutrients can persist in sediments in the lakebed and are released over time, which can then drive algal blooms. When algae die and decompose, the nutrients are re-released into the lake water, and the cycle continues.

The trophic level index (TLI) is a metric for lake health that combines nutrient, algae, and water clarity measurements. A TLI greater than 4 means a lake is more likely to have an algal bloom, especially during warmer months. Algal blooms can occur in lakes with a low TLI, but they are less likely to be problematic.

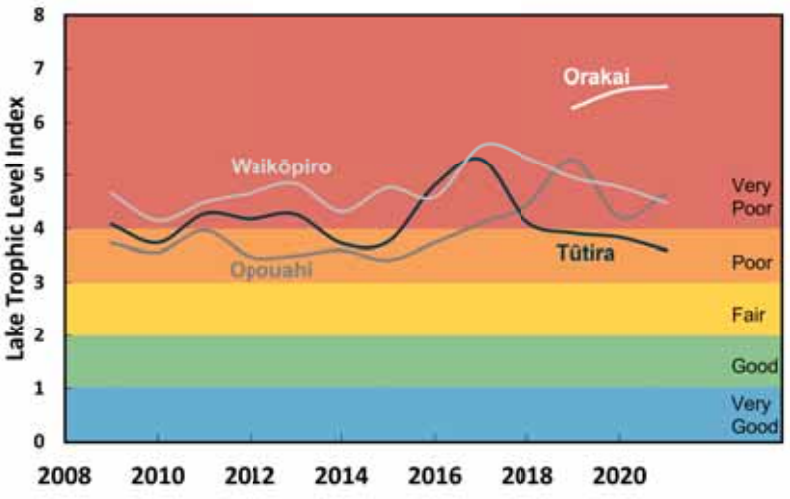


Figure 17-10. Trophic Lake Index for lakes in the Esk and Central Coast catchments. The TLI score for a lake is calculated using four separate water quality measurements: total nitrogen, total phosphorus, water clarity, and chlorophyll-a.

Tūtira

Tūtira Lake has a history of severe algal blooms. Tūtira's TLI has been below 4 for the last three years (Figure 17-10), and no fish kills have been observed recently. The risk of toxic blooms remains, but new monitoring equipment allows HBRC to detect algal blooms early so that warnings can be issued. The combination of improved water quality and enhanced monitoring allowed the permanent no-swimming advisory to be lifted in February 2021.

Waikōpiro

Waikōpiro has a TLI greater than 4, but its health has been steadily improving since its worst algal blooms in 2017 (Figure 17-9). An air curtain was installed in Waikōpiro at the end of 2017, as a trial to keep oxygen levels high at all depths of the lake to prevent severe algal blooms. During this period, conditions in Tūtira, which does not have an air curtain, also improved over the same period.

Opouahi

Opouahi has had a TLI of greater than 4 in recent years (Figure 17-9). This is surprising, because the majority of the lake's catchment is retired from farming and covered in native vegetation (Figure 17-11). One possible explanation for the degradation of water quality is the presence of grass carp, which may have increased the risk of algal blooms (see section on grass carp below).

Figure 17-11. Water quality in Opouahi Lake has degraded steadily since 2008 despite being surrounded by native vegetation.

Orakai

Described in 1986 as one of the most eutrophic (nutrient-rich) lakes in New Zealand, Orakai has had a TLI greater than 6 since monitoring began in 2018 (Figure 17-9), despite having a catchment that is now largely vegetated with no farming pressure. The small catchment has very little flushing, and so legacy nutrients from historic top dressing are recycled, keeping the lake in an unhealthy state. For this lake to recover, the legacy nutrient load may need to be removed.

Figure 17-12. Grass carp were introduced into the Tūtira lakes to eradicate the invasive weed Hydrilla .

Grass carp and *Hydrilla* – a complex story

Hydrilla is an exotic and highly invasive aquatic weed that smothers lake ecosystems. In the 1950s, it was discovered in Tūtira, Waikōpiro, Opouahi, and Eland's Lakes – the only locations it has been found in New Zealand to date. In 2008, the Ministry for Primary Industries released grass carp (Figure 17-12) into the lakes to eradicate this noxious weed. The eradication programme has been very successful in that regard, and no *Hydrilla* has been observed since 2016.

However, grass carp can have negative effects on ecosystem health, because they also graze and suppress other beneficial aquatic vegetation that absorb nutrients and compete with algae. Therefore, grass carp can cause lakes to have a higher risk of algal blooms. The pressure from grass carp also interacts with legacy nutrient loading in all four lakes.

Figure 17-13. Populations of kakahī (freshwater mussels) are rebounding following the Hydrilla eradication programme (photo by NIWA).

On the positive side, the removal of *Hydrilla* has enabled kakahī, a native freshwater mussel (Figure 17-13), to rebound. Kakahī filter organic material out of the water column, including algal particles, and so an increase in kakahī should have a positive influence on water quality.

In the long-term (circa 2050), when the eradication programme has finished and both *Hydrilla* and grass carp are gone, native vegetation and kakahī beds should flourish. In the meantime, grass carp may be an additional complication that negatively affects water quality, particularly in the smaller lakes Opouahi and Waikōpiro.

Coastal water quality

Suspended sediment, turbidity, dissolved oxygen, chlorophyll-a, nitrogen, and phosphorus levels in coastal waters of the catchment are within the ranges observed in other New Zealand open coast sites (Figure 17-14).

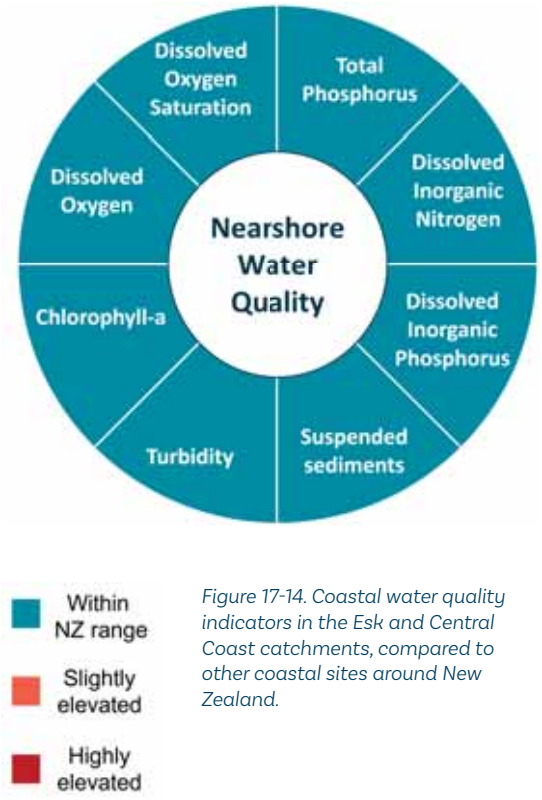


Figure 17-14. Coastal water quality indicators in the Esk and Central Coast catchments, compared to other coastal sites around New Zealand.

Recreational water quality

Like elsewhere in Hawke's Bay, coastal beaches in this catchment tend to have excellent water quality and are almost always suitable for swimming. However, the Esk River and Waipatiki Lagoon appear to have persistently poor recreational water quality (Figure 17-14).

The Waipatiki Lagoon/Stream continues to be largely unsuitable for swimming due to the presence of faecal material. Faecal source tracking in this catchment suggests mixed sources, including ruminants and birds. Large flocks of geese are often observed upstream of the lagoon, which may be contributing to the faecal sources. This site has also shown deteriorating water quality over the last 21 years.

Swimming was also not advised in the Esk River and Lake Tūtira a relatively high proportion of the time (9% and 8.5% respectively). Both sites were graded 'poor' for primary contact recreation.

Waipatiki Beach was the water body most suited for swimming, with 98% of samples swimmable.

Figure 17-15. Swimming suitability metrics for marine, estuarine, and freshwater sites in the Esk and Central Coast catchments. Swimmable = green and orange.