

## EAST COAST CONSERVANCY

### Motu River Catchment (26)

**Location:** Approximate centre of wetland (at the confluence of the Motu River and Waitangirua Stream) 38°12'S, 177°40'E; mouth of the river 37°47'S, 177°40'E. The mouth of the river is 41 km northeast of Opotiki on the East Coast of North Island. The river flows through the southwestern end of the Raukumara Range.

**Area:** Length of River: 115 km (below the Falls), 50 km (above the Falls). Total catchment area, 138,000 ha; catchment area relating directly to the Motu River as described in this account and covered by the National Water Conservation Order, 112,000 ha.

**Altitude:** Sea level to 500 m.

**Overview:** The Motu River and its tributaries flow through one of the last remaining extensive wilderness areas of the North Island. It remains one of the least modified rivers in New Zealand, and is regarded as one of the few remaining truly wild rivers in the North Island. The river and its catchment area support a variety of indigenous species, some of which are considered to be threatened. The Motu River system, as described here, includes the Waitangirua, Mangaotane, Te Kahika and Mangatutara Streams, and the Takaputahi River below the confluence at the Ngaupokotangata and Whitikau Streams.

**Physical features:** The Raukumara region has a complex geology. The catchment is dominated by Cretaceous rocks, mainly hard but brittle sandstone and siltstone through which the river has cut a steep-sided gorge. In many areas, folding and faulting have been intense, giving rise to deformed and shattered rocks with associated crush zones. Seismic activity is ongoing. Soft, highly erodible rocks occur in the Mangaotane tributary and parts of the upper catchment of the main river.

The Motu River has a mean flow of 90 cubic metres per second near its mouth, and is one of the largest rivers in the Bay of Plenty Region, although not a major river by New Zealand standards. The river is prone to flash-flooding, especially since groundwater storage in the catchment is small, and there is a high run-off into rivers. In the period 1958-1991, the maximum flow recorded was 2,849 cubic metres per second, while the mean annual flood flow is about 1,600 cubic metres per second. Major floods can occur in any month of the year, but flow patterns tend to follow a regular cycle, peaking in August and declining to a minimum in January or February. The catchment is not particularly prone to drought, and the forested catchment tends to maintain a significant flow in dry periods (mean minimum flow 13 cubic metres per second).

Although the catchment above the Motu Falls is mainly deforested farmland, the rest of the catchment is relatively unmodified and the Motu River water is considered of high quality. The unstable nature of the land together with the influence of high intensity rain storms means the area is subject to erosion, and consequently at times carries a large sediment load.

The mean annual rainfall of the Motu catchment varies from about 4,000 mm along the Raukumara Range to 1,400 mm at the coast. Rainfall is fairly evenly distributed throughout the year. The catchment is susceptible to high intensity rain storms, generally from a northerly quarter.

**Ecological features:** Some accessible areas of the catchment (in the southeast) were logged or cleared for farming, but the majority of it remains in natural vegetation. The vegetation in the Raukumara Range (which covers a large part of the river catchment) changes with altitude from podocarp-hardwood forest in the lower valleys to podocarp-beech in the upper valleys and pure beech forest on the high ridges. Many species and combinations of species are present, and some associations are unique to this region. The river bank is rich in native herbs

(*Gunnera* spp., *Leptinella squalida*, *Jovellana sinclairii* and *Gnaphalium keriense*), shrubs such as koromiko *Hebe* spp. (including one species with a restricted distribution), Mountain Flax *Phormium colensoi* and native broom. In the final 10 km of the river, coastal trees begin to appear, firstly Kohekohe *Dysoxylum spectabile* and Karaka *Corynocarpus laevigatus*, and later Pohutukawa *Metrosideros excelsa* and Puriri *Vitex lucens*. Indigenous forest and shrubland have been replaced by plantation forests of the exotic *Pinus radiata* on the southwest side of the river near the river mouth, but indigenous forest continues right to the coast on the northeast side.

**Land tenure:** The river bed is Crown land administered by the Department of Survey and Land Information. Crown land held as Conservation Area and other reserves comprise some 64% of the catchment; the balance is private land, most being multiply-owned Maori land.

**Conservation measures taken:** In 1984, a National Water Conservation Order was placed on the Motu River below the Motu Falls (including the tributaries as listed above) down to the mouth. The order preserves the river as far as possible in its natural state, and no rights to dam the river will be granted. This order in effect protects the river itself from development. Some 64% of the catchment area is Crown land held as Conservation Area in the Raukumara Forest Park (formerly State Forest). This is administered and managed by the Department of Conservation for conservation purposes. Some 920 ha of private forest land in the Takaputahi catchment were recently purchased for conservation purposes. Logging and clearing of forest land are restricted by the Bay of Plenty Regional Council under the Resource Management Act.

**Conservation measures proposed:** No further proposals are known.

**Land use:** Recreational uses include fishing, canoeing, rafting and jet-boating. In particular, the river is regularly used for wilderness white-water rafting. The nearest population centre is Opotiki, with a population of 31,185. The Motu River area is considered a valuable area for water-based recreation, in part because of road access to either end of the wilderness corridor formed by the river and its adjoining shorelines. The forest park is used mainly for conservation purposes and recreational uses such as tramping and hunting. The difficulty of access to much of the area and remoteness from major population centres tend to make it a wilderness experience, and limit the number of recreational users. Minor areas of the immediate catchment are used for extensive pastoral farming (Mangaotane, Takaputahi and Waitangirua) and exotic plantation forestry (on the lower left bank of the Motu and on the Rawaia tributary of Takaputahi River).

**Possible changes in land use:** None foreseen.

**Disturbances and threats:** Prior to the National Water Conservation Order coming into force, the Motu River was subject to hydro-electric power investigations. The likelihood of hydro-electric development has been reduced through the National Water Conservation Order. Feral animals such as goats and possums have a detrimental influence on the forest ecology. Goats, in particular, have had a major impact on the western side of the Motu. Control efforts aim to prevent a significant population becoming established on the eastern bank. Because of its steep topography and the intensity of rainstorms, the area is prone to erosion, particularly in the southeast (a tendency exacerbated by past deforestation in some areas).

**Hydrological and biophysical values:** The river system plays a general role in maintenance of water quality, and is of importance in supporting aquatic and terrestrial food chains. Groundwater storage in the catchment is small. The Motu supports fisheries for whitebait and eels.

**Social and cultural values:** The Motu River is regarded as one of New Zealand's most beautiful rivers because of its isolation, its numerous rapids and cascades, and the beauty of the indigenous forest flanking the river. Some slopes near the mouth of the river have been cleared and planted with exotic pine trees, and this detracts from the scenic values in this area. Various

outdoor recreational activities occur, especially rafting. The river has particular importance to the Whakatohea and Whanau Apanui "iwi", and is used for traditional eeling in its mid and lower reaches.

**Noteworthy fauna:** The Motu River and its associated catchment provide habitat for a wide range of bird species, particularly forest birds. Notable species recorded in the area include North Island Brown Kiwi *Apteryx australis mantelli*, New Zealand Falcon *Falco novaeseelandiae*, North Island Weka *Gallirallus australis greyi*, Kaka *Nestor meridionalis septentrionalis*, Red-crowned Parakeet *Cyanoramphus novaezelandiae*, Yellow-crowned Parakeet *C. auriceps* and North Island Robin *Petroica australis longipes*.

The river and its tributaries are particularly important for the Blue Duck *Hymenolaimus malacorhynchus*, a species dependent on fast-flowing rivers and streams. The Motu and its tributaries provide high quality habitat for this species, and support a population of up to 80 birds, one of the largest populations in the North Island. The majority of these birds probably live on the tributaries, with the main Motu River being used by displaced juveniles and adults for a period after the breeding season.

The river supports nine indigenous species of fish, the principal species being the Long-finned Eel *Anguilla dieffenbachii*, Koaro *Galaxias brevipinnis*, Blue-gilled Bully *Gobiomorphus hubbsi* and Torrent Fish *Cheimarrichthys forsteri*. A healthy Brown Trout *Salmo trutta* population is also present. The endemic Hochsetter's Frog *Leiopelma hochstetteri* is numerous. Two endemic species of bat, the Short-tailed Bat *Mystacina tuberculata* and Long-tailed Bat *Chalinolobus tuberculatus*, occur in the area, along with various introduced mammals including Red Deer *Cervus elaphus*, wild cattle, wild pigs, possums and goats, some of which are present at high densities. The Motu catchment is regarded as a haven for many species of terrestrial invertebrates, particularly land snails.

**Noteworthy flora:** No threatened species are known from the catchment, but the flora is not well documented.

**Scientific research and facilities:** Detailed research was undertaken in preparation for the application for the National Water Conservation Order. This research included hydro-electric power investigations, landscape and recreation studies, and faunal research. There are no research facilities in the locality, although nearby small towns provide accommodation.

**Conservation education:** There are no known programmes or facilities for conservation education and training, although the area received wide media coverage at the time of the Conservation Order application, and this has stimulated more interest in the area. Opportunities for conservation education are good.

**Recreation and tourism:** The Motu River is a significant recreational area, especially for local use. Outdoor recreational pursuits include tramping, hunting, fishing, canoeing, rafting, jet-boating and camping. Commercial rafting trips are popular, especially in the summer months. Fishing was demonstrated to be the most common activity in terms of numbers of people. This occurs in the lower Motu River. Different recreational activities tend to occur in different parts of the river, but some concern has been expressed about possible conflicts between some activities if their popularity increases significantly.

**Management authority:** The Department of Conservation (East Coast Conservancy) is responsible for the management of conservation areas and wildlife. The Bay of Plenty Regional Council has statutory responsibilities under the Resource Management Act 1991 for water resources and the preparation of coastal plans. The Eastern Fish and Game manages sport fishing and game-bird hunting.

**Jurisdiction:** Functional: Department of Survey and Land Information, Ministry for the Environment, Department of Conservation and Eastern Fish and Game Council. Territorial: Bay of Plenty Regional Council and Gisborne District Council.

**References:** Ministry of Works and Development (1985); Penny (1982); Queen Elizabeth II National Trust (1983); Ritchie *et al.* (1982).

**Reasons for inclusion:**

- 1a The Motu River is a particularly good representative example of an unmodified river with steep gradient and absence of lake storage, a wetland type characteristic of New Zealand.
- 2a The river and its tributaries support substantial populations of the globally threatened Blue Duck *Hymenolaimus malacorhynchus* and Hochsetter's Frog *Leiopelma hochstetteri*. Several other threatened species are associated with the surrounding catchment area.
- 2b The Motu River catchment supports a very diverse flora, including some plant associations unique to this region, and a diverse fauna including many species of terrestrial invertebrates, birds and bats; it is thus of special value for maintaining the genetic and ecological diversity of the region.
- 2d The river and its tributaries are of special value for their endemic plant and animal species, including *Leptinella squalida*, *Hymenolaimus malacorhynchus* and *Leiopelma hochstetteri*.
- 3c The river and its tributaries support over 2% of the world population of *Hymenolaimus malacorhynchus*.

**Source:** Denise Nelson.

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### Mohaka River and Tributaries (27)

**Location:** Approximate centre of the wetland (at the confluence of the Mohaka and Waipunga Rivers) 39°06'S, 176°41'E. The Mohaka River flows into Hawkes Bay and is approximately 48 km northeast of Napier on the east coast of the North Island. Its headwaters are in the Kaweka and Kaimanawa Ranges in the central North Island.

**Area:** The main river is about 140 km long; the catchment area is approximately 237,000 ha.

**Altitude:** Sea level to 1050 m.

**Overview:** The Mohaka River has outstanding wilderness, scenic and other natural characteristics. In addition, it supports an important trout fishery and natural amenities for water-based sports and other recreational activities. Some threatened endemic species of plants and animals are present.

**Physical features:** The site comprises the waters of the main stem of the Mohaka River above the State Highway 5 Bridge, the waters in all the tributaries (except those of the Te Hoe River south of the Te Hoe Gorge), and the waters of the main stem in the Mokonui Gorge.

The geology of the area includes rock formations from the late Cretaceous period as well as sedimentary fossiliferous rocks of the Miocene period. Impressive deep valley sides with sheer walls towering above the river and spectacular sculptures and huge boulders are features of the river and its tributaries. The area is prone to slips. In 1985, a huge rockfall 3.5 km downstream of the Te Hoe confluence dammed the river to a depth of 12 m and created a lake 2 km long. Since then, the lake has slowly subsided.

The mean flow of the Mohaka River is 39 cubic metres per second at Glenfalls (at State Highway 5 bridge) and 81 cubic metres per second at Raupunga (at State Highway 2 bridge). The river is subject to just over 12 floods per year; mean annual flood flows are 403 cubic metres per second at Glenfalls and 833 cubic metres per second at Raupunga. The river has consistent flows, a stable bed and minimal changes in depth, temperatures and current. Despite

the periodic floods, its recovery after these has always been rapid and dependable. Concentrations of suspended sediment in the river at Raupunga are variable and generally increase with water discharge. Water quality is generally high, despite the level of erosion and the soft geology through which the river passes.

Annual rainfall is high; the catchment receives rainfall from westerly winds, even during periods of drought elsewhere in the district.

**Ecological features:** The original indigenous forest cover has been removed from all except the headwater areas. Much of the inland catchment area has regenerated indigenous vegetation cover, while the middle and downstream reaches of the river pass through areas of exotic production forestry and pastoral farming. No extensive botanical survey has been undertaken, but of interest are the altitudinal sequences of riparian vegetation from the headwaters to the river mouth. The Mohaka River is also notable for the absence of an exotic aquatic weed problem. The catchment area provides suitable habitat for many indigenous forest bird species.

**Land tenure:** Part of the river bed is Maori owned; the title of the East Taupo Lands Trust (Ngati Tuwharatoa Iwi) extends to the middle line of the river in the upper catchment. The remainder is currently Crown land. However, this is subject to a claim under the Treaty of Waitangi, put by the Ngati Pahauwera.

Land ownership in the catchment is a mixture of private land, New Zealand Timberlands Ltd., Crown land, Maori land and Crown land administered by the Department of Conservation.

**Conservation measures taken:** No protected areas have been established. The district and regional plans of the local authorities having jurisdiction over the area provide some means of control for soil and water conservation and management.

**Conservation measures proposed:** A Draft National Water Conservation Order for the Mohaka River was published on 31 March 1991 by the Planning Tribunal. This draft order recognised the outstanding characteristics of the river, and restricted damming of the river and its tributaries throughout their length. The draft order was appealed against, and the Planning Tribunal reviewed and amended the draft order in 1992.

The amended Draft National Water Conservation Order recognises various outstanding characteristics and features (trout fishery, scenic characteristics and amenity value for water-based recreation) in parts of the river and its tributaries. It protects the catchment above State Highway 5 bridge; allows dams of 35 m at Te Hoe and 70 m at Raupunga; protects all tributaries (*e.g.* Waipunga) with the exception of part of the Te Hoe River; and protects Mokonui Gorge and tributaries, and Te Hoe Gorge. It does not, however, protect the amenity/recreation values between State Highway 5 bridge and Mokonui Gorge. The Waitangi Tribunal considered the validity of the order in relation to the Treaty of Waitangi, in 1992. The process is currently the subject of a legal investigation.

**Land use:** The Mohaka catchment is sparsely populated and supports approximately 1,800 people in a number of small settlements. The middle and lower reaches include areas of production forestry and pastoral farming. As the economics of the latter become more marginal, exotic production forestry is expanding. Gravel extraction occurs at a number of sites in the river. The Mohaka River is a regionally significant source of this material which is in short supply. The ease of access into the catchment at various points makes the area important for a range of water-based recreational pursuits, including commercial rafting and sport fishing. The principal land-use activities in the catchment area are pastoral farming, exotic plantation forestry and recreational use of areas adjoining the river, *e.g.* picnicking, tramping, camping and hunting.

**Possible changes in land use:** Hydro-electric power investigations have been carried out on the river. The Planning Tribunal in the amended National Water Conservation Order indicated that the Order would not preclude dams being built on the lower Mohaka River outside the

area included in the Order. None is planned at present. Further expansion of exotic forest plantations may occur in the catchment area.

**Disturbances and threats:** Three types of activity have been identified as having the potential to affect the outstanding characteristics and features of the Mohaka River and its tributaries.

- Hydro-electric development would affect the flow of the river and therefore the fauna associated with it (including the trout fishery); it would also affect the amenity value in relation to water-based recreation and the scenic value of the river.
- Intensification of land use has the potential to affect the riparian margins and water quality. For example, logging operations from the production forestry in the middle and lower reaches may increase silt loading, run-off and possible erosion.
- Inadequately controlled gravel extraction or water abstraction have the potential to affect habitat quality and availability. This is the case with gravel extraction in the middle section of the river.

**Hydrological and biophysical values:** The Mohaka River is important for flood control; a special feature of the river is its ability to clear quickly after floods. It has a stable river bed and no aquatic weed problems, unlike other rivers in the area. It is of importance in supporting aquatic food chains, particularly in relation to the trout fishery. The Mohaka River has been rated as being a nationally important scenic and recreational fishery (MAF Fish criteria) in relation to the trout fishery. The Mohaka is unique because of the sheer number and size of fish present, and because it is unusual for Brown Trout *Salmo trutta* to predominate in the headwaters of a mixed fishery. The river is also a recognised whitebait and eel fishery. Fishing activity at the mouth of the river concentrates on whitebait, eels and marine species.

**Social and cultural values:** The Mohaka River and its tributaries have outstanding wilderness and scenic characteristics. The section from the Organs to Willow Flat on the main stem of the Mohaka River and the Te Hoe River Gorge are considered to be nationally outstanding. The Mohaka River has special significance as being one of the last major wild and scenic rivers in central North Island, in the sense that it flows untrammelled from its source to the sea. The trout fishery above the confluence of the Te Hoe River and the Mohaka River is considered to be outstanding, as is the amenity value of the river for water-based recreation on the Mohaka River mainstream from Pungahuru to Willow Flat. Significant finds of fossil-containing rocks have been made in the Te Hoe River.

There are strong Maori associations with the river; a number of "urupa" (burial grounds) occur along the river, and the river itself is a traditional food source. The river is a treasured "taonga" (treasured and valued inherited resource) for both the Ngati Tuwharetoa and the Ngati Pahauwera Iwi.

**Noteworthy fauna:** The Mohaka River and its tributaries support a highly fragmented population of the Blue Duck *Hymenolaimus malacorhynchus*, consisting of a number of isolated groups of birds which together total less than 60 individuals. Safeguarding this population of Blue Ducks depends on protecting the headwaters of the river and restoring the lower section of the river to allow the small fragments of the population to interact and interbreed. Other notable waterbirds include the Banded Dotterel *Charadrius bicinctus*, which occurs on shingle habitat at the mouth of the river.

Ten indigenous species of freshwater fish have been recorded in the river, but little quantitative information is available on these. Rainbow Trout *Oncorhynchus mykiss* and Brown Trout *Salmo trutta* are widespread throughout the river and its tributaries, while marine fish have been recorded at the mouth of the river. Other wildlife includes bats *Chalinolobus* sp. which roost in some gorges and riparian areas, and feed on aquatic insects. There are said to be exceptional numbers of sub-surface insect larvae and pupae which support and maintain the trout populations.

**Noteworthy flora:** A botanical survey of the Upper Ripia Valley revealed more than 50 plants of *Pittosporum turneri* in two gullies. This is one of only six sites known for this species, and the only site in the eastern Volcanic Plateau. Other notable plants in the Mohaka River catchment include the tussock *Chionochloa flavicans*, which is confined to small areas of the eastern North Island, and the calceolaria *Jovellana sinclairii*, a species restricted to the east coast of North Island and thought to be the native herbaceous plant with the most restricted distribution in New Zealand.

**Scientific research and facilities:** Initial research into hydro-electric power generation has been undertaken. Some botanical and faunal investigations were undertaken in preparation for the Planning Tribunal hearings on the Draft National Water Conservation Order. Searches for fossils are being carried out. No facilities exist in the immediate area for scientific research, although the area is close to Napier city, where there are facilities.

**Conservation education:** The Mohaka River system is an important venue for outdoor education and experience for young people. Because of its relatively easy access, the area provides an ideal location for conservation education.

**Recreation and tourism:** Recreational use is made of the river system for angling, canoeing, kayaking, rafting and jet-boating. A variety of water conditions for all levels of skill and experience is available for canoeing and rafting. The upper reaches of the Mohaka River and its tributaries possess outstanding trout fisheries for both Brown and Rainbow Trout. Despite limited access to parts of the river and its distance from a population centre, the river is heavily fished (over 7,000 visits in 1989). It contains a great variety of water conditions for fishing. Recreational activities include tramping, picnicking, camping and hunting.

**Management authority:** The Department of Conservation (East Coast Conservancy, Hawkes Bay Conservancy and Bay of Plenty Conservancy) is responsible for the management of conservation areas, freshwater fisheries and wildlife. The Tongariro Regional Council and Hawkes Bay Regional Council have statutory responsibilities under the Resource Management Act 1991 for water resources, and the Hawkes Bay Regional Council has responsibility for preparation of coastal plans. The Eastern Fish and Game Council manages of sport fishing (trout and salmon) and game-bird hunting.

**Jurisdiction:** Functional: Department of Conservation and East Coast Fish and Game Council. Territorial: Tongariro Regional Council, Hawkes Bay Regional Council, Taupo District Council, Wairoa District Council and Hastings District Council.

**References:** Ministry for the Environment (1989, 1990); Planning Tribunal (1992).

**Reasons for inclusion:**

- 1a The Mohaka River and its tributaries are a good example of an unmodified, deeply gorged river, a wetland type characteristic of New Zealand.
- 2a The Mohaka River and its tributaries support populations of a threatened species of plant, *Pittosporum turneri*, and a threatened species of bird, *Hymenolaimus malacorhynchus*.
- 2b The Mohaka River and its tributaries support a diverse flora, including several species with restricted distributions, and a diverse fauna, including ten indigenous fish; they are thus of special value for maintaining the genetic and ecological diversity of the region.
- 2d The river and its tributaries are of special value for their endemic plant and animal species.
- 3c The river and its tributaries support almost 2% of the world population of *Hymenolaimus malacorhynchus*.

**Source:** Denise Nelson and Pam Cromarty.

## HAWKES BAY CONSERVANCY

### Ahuriri Estuary and Associated Wetlands (28)

**Location:** 39°30'S, 176°52'E. Adjacent to and immediately to the north of the City of Napier, Hawkes Bay Region, on the east coast of North Island.

**Area:** Estuary proper (including outfall channel) c.470 ha; five adjacent wetlands c.175 ha.

**Altitude:** Sea level.

**Overview:** A much modified estuarine wetland complex which continues to support a rich avifauna of both sedentary and migratory waterbirds; the tidal flats in particular are important for birds. Despite its relatively small size, a variety of substrates, salinity levels and plant communities are present, providing a wide diversity of habitats. It is the most significant wetland along the entire length of the eastern coastline of North Island between East Cape and Wellington, because of the paucity of coastal wetlands along this stretch of coastline. It has important ecological, recreational, historical and cultural values.

**Physical features:** The existing estuary had its origins as a largely freshwater lagoon about 3,840 ha in size. The Tutaekuri River formerly flowed into the lagoon, and there was a small opening to the sea near Bay View. Rough seas often closed the outlet for long periods. The massive "Napier Earthquake" of February 1931 (registering 7.75 on the Richter scale) lifted the land by two metres and exposed about a third of the bed of the lagoon. Subsequent drainage and reclamation of the exposed portions have further reduced the estuary to its existing size (about 470 ha). Much of the margin of the estuary is contained by man-made stop-banks. There are five smaller wetlands, totalling some 175 ha, within reclaimed land near the estuary. Although not immediately adjacent to the estuary, they are sufficiently close to be considered part of the Ahuriri wetland complex, and contribute significantly to the overall value of the area.

The Tutaekuri River now empties into the sea to the south of Napier via a man-made channel, and the main freshwater inflows to the estuary now come from a number of small streams and drains. Maximum daily freshwater inflow into the estuary varies greatly, with 2,450 million litres being recorded in August 1977 and 40 million litres in January 1978. On average, the seawater to freshwater ratio is approximately 10:1, and the average tidal exchange is in the order of 495 million litres.

The total catchment area is 13,128 ha. The soils of the catchment have been formed on siltstones, sandstones and limestone, and are generally very stable. Estuarine sediments are mainly fairly coarse marine sands and gravels on the lower section of the estuary, graduating to finer alluvial silt deposits further up the estuary.

The estuary is relatively shallow, with about 60% of its bed being exposed at low tide. The approaches to the Pandora bridge constrict tidal flow into and out of the estuary, delaying and muting tidal influences. The tidal range at sea in the Napier area varies between 1.8 m (spring tides) and 1.3 m (neap tides); the tidal range in the middle of the estuary varies between 0.52 m (spring tides) and 0.2 m (neap tides).

Some physico-chemical characteristics of the water are as follows:

-	pH	7.2 to 9.4
-	Temperature	9.5 to 30°C
-	Salinity	0.32 to 23.7‰
-	Dissolved oxygen	7.7 to 13.1 g/m <sup>3</sup>
-	Ammonium nitrogen	0.054 to 0.550 g/m <sup>3</sup>
-	Nitrate nitrogen	0.086 to 0.590 g/m <sup>3</sup>
-	Ortho-P	0.141 to 0.421 g/m <sup>3</sup>



The climate is temperate, with an annual rainfall of 600-1,000 mm (summer droughts are common), average temperatures of 19°C in January and 9°C in July, and average annual sunshine of 2,200 hrs.

**Ecological features:** The long, narrow nature of this estuary combined with the wide variety of saline conditions, water depths, flow characteristics and sediments, provides for an extremely diverse range of ecological communities, all contained within a relatively small area. In the more saline lower reaches, inter-tidal marginal vegetation is dominated by Glasswort *Salicornia australis*. Patches of Sea Rush *Juncus maritimus*, the chenopod *Chenopodium glaucum*, Buck's Horn Plantain *Plantago coronopus*, Batchelor's Button *Cotula coronopifolia* and some Saltmarsh Ribbonwood *Plagianthus divaricatus* also occur here. Algal species such as Sea Lettuce *Ulva lactuca*, *Enteromorpha* sp., the red alga *Corallina officinalis*, the brown algae *Colpomenia sinuosa* and *Cystophora torulosa*, and the green alga *Codium adhaerens* appear in the mid-tidal zones.

In the middle estuarine area, the marginal vegetation zone is somewhat restricted by the stop-banks. Most of the species found in the lower estuary are present in this middle zone, with *Salicornia* dominating in the upper inter-tidal zone. Moving up the estuary through this section, the most obvious change in flora occurs in the mid-tidal zone. As the salinity decreases and the sediments become finer, patches of the eelgrass *Zostera muelleri* are found in the mid-tidal zone, and the water weed *Ruppia* sp. and green algae such as *Enteromorpha* sp. are abundant. The upper tidal plants in the middle estuarine section are similar to those found in the lower estuary.

In the upper estuarine section, extending northwards from the Taipo stream confluence, there are substantial remnants of the once extensive wetlands that bordered Ahuriri Lagoon. Here there are large areas colonised by rushes *Juncus* spp. and sedges, especially the Three-square Sedge *Scirpus americanus*. Further up this stretch, where conditions become less saline, there are large areas dominated by Raupo *Typha orientalis*.

**Land tenure:** Ownership of the estuary is currently vested in the Crown and administered by the Department of Conservation. The Westshore Domain, lying to the north of Embankment Road Bridge and including the Westshore Lagoon, is a 50 ha Crown-owned Recreation Reserve and Wildlife Refuge with management and control vested in the Napier City Council. The Hawkes Bay Airport Authority also owns land adjoining the northern side of the middle estuary. On the southern side, privately owned industrial land abuts the estuary in its lower reaches. Between Embankment Road Bridge and the Taipo Stream, there is a large farm (Lagoon Farm) owned and operated by the Napier City Council. Along the western perimeters, private farmland and some Crown Leasehold (Department of Conservation) adjoin the estuarine perimeters. To the north and east of the estuary, the majority of land is owned by Landcorp Farming Ltd (a state-owned enterprise).

**Conservation measures taken:** Much of the estuary is already Crown owned and administered by the Department of Conservation. It is anticipated that the balance will also soon be vested in the Department. Some 160 ha of the lower and middle estuary are Wildlife Refuge (New Zealand Gazette 1958 p.654). Other wetland areas (totalling 103 ha) that have been isolated from the main estuary as a result of reclamation works have also been allocated to the Department of Conservation, and are held as Conservation area under the Conservation Act 1987. They are part of the five smaller wetlands adjacent to the estuary proper. Leasehold lands along the western margins of the upper estuary which include some marginal wetland vegetation are being fenced-off by the Department of Conservation, and retired from grazing as part of an on-going programme. Some additional protection is afforded by way of the operative Hastings District Planning Scheme and the City of Napier District Scheme. Special zonings have been applied in these schemes to protect the natural character and existing values

of significant parts of the estuary, and to ensure its continued suitability as a flood protection and drainage channel.

**Conservation measures proposed:** A Management Plan is currently being prepared under the oversight of a Joint Political Committee comprising members of the Hawkes Bay Regional Council and the Napier City Council. The Department of Conservation has played a major role in the preparation of those sections of the Management Plan that deal with ecological values. The Management Plan, which is nearing completion, will then be adopted in the above Schemes, and will guide planners and decision makers in the future management of the estuary and its catchment.

**Land use:** (The "Inner Harbour" area which contains commercial fishing and boating facilities has not been considered part of the estuary for the purposes of this inventory). Recreational use of the lower estuary is quite intensive and includes swimming, sailing, wind-surfing, canoeing, fishing (with line, net and spear), bird-watching, photography, picnicking, hiking, running and shellfish gathering. A public walkway has been provided around the lower estuary and across Embankment Road Bridge. Because of the lengthy periods during which tides expose large areas of mudflat, the middle reaches of the estuary are less attractive to the water-based water sports. This area is used for some shellfish gathering and canoeing, but is left mainly undisturbed. As a result, it attracts shorebirds and is of considerable interest to bird-watchers. Recreational pursuits on the upper estuary are restricted to bird-watching and duck hunting. Agricultural and horticultural activities dominate adjoining land uses (c.80%), followed by public utilities *e.g.* roads and bridges (10%), industrial uses (5%) and public amenities *e.g.* parks and picnic areas (5%).

**Possible changes in land use:** No major changes are envisaged in the estuary itself. The estuary is not suitable for aquacultural use for any of those species presently being farmed commercially in New Zealand. Parts of the pastoral area adjacent to and immediately to the south of the middle estuary area have been zoned for future commercial and industrial development. Low-density residential areas are being developed on rural-zoned land at Poraiti, on the southern end of the hill country to the west of the upper estuary. Other changes to the rural-zoned hill areas include conversion from pastoral farming to horticulture and farm-forestry.

**Disturbances and threats:** Potential disturbances and threats include the following: accidental pollution from adjoining industrial land; accelerated siltation caused by new developments and changing land uses on surrounding lands; the routing of a new motorway across the middle estuary; increased human activity having a detrimental impact on waterfowl populations; illegal reclamation; grazing of cattle on saltmarsh vegetation; indiscriminate hunting of protected species by waterfowl hunters; and over-exploitation of shell beds.

**Hydrological and biophysical values:** The estuary is important for flood control because it acts as a temporary flood storage for run-off from the surrounding hill catchment during periods of high rainfall. It is an important drainage channel for gravity-fed streams and drains, and acts as a nutrient and sediment trap benefitting water quality and estuarine biota. The waters of the Ahuriri Estuary are high in organic nutrients which enter the system via the inflowing streams and drains from the surrounding land. Abundant algae and plankton flourish in the enriched waters, and form a rich food source for invertebrates at the bottom of the food chain.

**Social and cultural values:** Situated directly alongside the city of Napier (population 54,000 in 1990) and only 20 km from the city of Hastings (population 61,000 in 1990), the estuary attracts a great deal of interest and recreational use. Traditional Maori use has involved the gathering of a variety of shellfish, such as the cockle *Chione stutchburyi* and Pipi *Paphies australis*, and fin-fish, such as Inanga *Galaxias maculatus*, patiki (flounders) *Rhombosolea* spp., eels *Anguilla* spp., Awa (mullet) *Aldrichetta forsteri* and *Mugil cephalus*, Kahawai

*Arripis trutta* and Parore *Girella tricuspidata*. All of these species with the exception of Pipi and Inanga are taken today. The estuary and its surrounding lands are culturally very rich, and are respected and prized by the local "iwi" (Ngati Kahungunu). There are some important archaeological sites in the near vicinity of the estuary. The emphasis placed on the cultural and traditional significance of Ahuriri Estuary is reflected in a current land claim before the Waitangi Tribunal made on behalf of the Ngati Kahungunu people.

Maori habitation dates from pre-1100 AD. Attracted by plentiful "kaimoana" (seafoods) and a climate ideally suited to plant cultivation, several tribes colonised the area and much conflict occurred. Several islands formerly surrounded by water were fortified as "pa". The original lagoon was known as Te Whanganui A Orotu. During periods of heavy on-shore seas, the lagoon mouth would block, causing a rise in lagoon levels. To assist food gathering and to prevent the flooding of low-lying dwellings and cultivation, the local Maori would excavate an opening to the sea. The first European settlers arrived in the mid-19th century, and by 1870 reclamation of the lagoon perimeters began to allow the expansion of the township of Napier. The diversion of the Tutaekuri River away from the lagoon was completed by 1935. This, combined with the 1931 earthquake and subsequent reclamation, brought about the enormous environmental changes that have seen the character of the Ahuriri area change from an extensive largely freshwater lagoon to a much smaller and more saline estuary.

**Noteworthy fauna:** The estuary has been identified as a "Site of Special Wildlife Interest" (SSWI) and ranked as "high" value by the Fauna Survey Unit of the New Zealand Wildlife Service. This is a nationwide wildlife habitat ranking system officially recognised by the Department of Conservation. The estuary is of national importance for wintering Royal Spoonbill *Platalea regia* (regular visitor, up to 30 in autumn, winter and early spring) and Great Egret or White Heron *Egretta alba* (up to 5 in winter), and of regional importance for Australasian Bittern *Botaurus poiciloptilus* (breeding resident), Grey Teal *Anas gracilis*, New Zealand Shoveler *Anas rhynchos variegata*, Marsh Crake *Porzana pusilla affinis* and Black-fronted Dotterel *Charadrius melanops*. Other notable species include: New Zealand Dabchick *Poliocephalus rufopectus* (non-breeding visitor, up to 10 birds), Pacific Reef Egret *Egretta sacra* (irregular visitor), Banded Dotterel *Charadrius bicinctus* (breeds, up to 75 in winter), Wrybill *Anarhynchus frontalis* (up to 10 in winter), Far Eastern Curlew *Numenius madagascariensis* (occasional summer visitor), Asiatic Whimbrel *N. phaeopus variegatus* (regular summer visitor), American Whimbrel *N. phaeopus hudsonicus* (occasional visitor), Siberian Tattler *Tringa brevipes* (occasional visitor), Sharp-tailed Sandpiper *Calidris acuminata* (20-30 in summer), Red-necked Stint *C. ruficollis* (regular in summer in small numbers, with some remaining throughout the winter), Caspian Tern *Sterna caspia* (up to 50 present throughout the year but not known to breed), and Little Tern *Sterna albifrons* (occasional visitor). Altogether, some 55 species of birds (excluding introduced passerines) have been recorded on the estuary. These include three species of shag *Phalacrocorax* spp. six species of herons (Ardeidae), seven species of wildfowl (Anatidae), 26 species of shorebirds (17 of which are migrants from the Arctic), and seven species of gulls and terns (Laridae). The most abundant migratory shorebirds from the northern hemisphere are Bar-tailed Godwit *Limosa lapponica*, Red Knot *Calidris canutus*, Pacific Golden Plover *Pluvialis fulva* and Ruddy Turnstone *Arenaria interpres*.

Ahuriri Estuary is an important nursery area for fish. Twenty-nine species of fish have been recorded, the dominant species being Short-finned Eel *Anguilla australis*, Yellow-bellied Flounder *Rhombosolea leporina*, Sand Flounder *Rhombosolea plebeia*, Yellow-eyed Mullet *Aldrichetta forsteri* and Parore *Girella tricuspidata*. Eleven species utilise the estuary as a breeding ground and nursery, and 12 species of commercial importance (or potential commercial importance) frequent the estuary, entering on the incoming tide and returning to sea on the outgoing tide.

The invertebrate fauna is abundant and diverse, reflecting the plentiful supply of algae and plankton that flourish in the enriched waters of the estuary. Thirty-three species have been recorded, including: three species of bivalves, the most abundant being the cockle *Chione stutchburyi*; seven gastropods including the whelk *Cominella glandiformis* and hornshell *Zeacumantus lutulentus*; six crustaceans, the most common being the tunnelling mud crab *Helice crassa*; 14 polychaete worms, the most numerous being *Aonides trifidus* and *Scolecoclepidus*; and one nemertine worm.

**Noteworthy flora:** Largely because of the highly modified nature of this estuary, it does not support any plant or plant communities of importance or rarity. A small remnant stand of the Saltmarsh Ribbonwood *Plagianthus divaricatus* survives in the lower estuary, and serves as a reminder of the far more extensive areas present prior to the 1931 earthquake and subsequent reclamation. This is of local importance because of the low occurrence of this species throughout Hawkes Bay. The transition of the plant communities from saline tolerant in the lower sections through to freshwater communities in the upper sections is an interesting educational feature, and provides a diversity of habitat types not found elsewhere in Hawkes Bay south of the Wairoa coastal lagoons.

**Scientific research and facilities:** Scientific investigations have been carried out on sedimentation, water quality, hydrology, ecology, fish and invertebrate macrofauna, marginal vegetation and wildlife. The local branch of the Ornithological Society of New Zealand has carried out twice-yearly counts of waterfowl on the estuary since 1971. No research facilities exist on the estuary.

**Conservation education:** In recent years, the Department of Conservation has included the estuary in its "Summer Programme" educational visits. A walkway has been established which circumnavigates the lower estuary, and interpretation display boards are incorporated in this. Situated close to two large population centres and being the only estuarine area of any consequence in Hawkes Bay, Ahuriri Estuary is often used for Primary and Secondary School educational studies and also by the Hawkes Bay Polytechnic. The Napier City Council has established meeting/lecture facilities on the Wildlife Refuge at Westshore Lagoon.

**Recreation and tourism:** The estuary is subject to intensive recreational use (see under "Land use", above).

**Management authority:** The estuary comes jointly under the management and control of the Department of Conservation and the Hawkes Bay Regional Council.

**Jurisdiction:** Hawkes Bay Regional Council and Napier City Council. The Department of Conservation and the Ministry of Agriculture and Fisheries have functional jurisdiction for conservation purposes.

**References:** Daly & Rijkse (1976); de Leon (1978a, 1978b); Department of Lands and Survey (1982); Estuarine Research Unit (undated); Henriques *et al.* (1987); Hunnabell & Spackman (1974); Imber (1978); Kilner & Ackroyd (1978); Knox (1979); Knox *et al.* (1978); Napier City Council (1984, 1985); Porter (1978); Turner (1974); Voice (1978).

**Reasons for inclusion:**

- 2a Ahuriri Estuary supports appreciable numbers of three globally threatened species of birds, *Poliiocephalus rufopectus*, *Botaurus poiciloptilus* and *Anarhynchus frontalis*.
- 2b The estuary supports a very diverse fauna, including 55 species of birds, 29 species of fish and 33 species of invertebrates, and is thus of special value for maintaining the genetic and ecological diversity of the region.
- 2c The estuary is of special value as a breeding ground and nursery for a number of species of fish, and as a wintering area for migratory shorebirds.
- 3c The estuary regularly supports over 1% of the regional population of *Sterna caspia*.

**Source:** John Adams.