



North Otago Freshwater Management Unit (FMU)

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Map: North Otago FMU



Introduction

The North Otago FMU extends from Waitaki bridge, down through Oamaru, Moeraki, and Palmerston townships and to the bottom of the southern branch of the Waikouaiti River.

High natural character values exist in the upper catchments of the Kakanui, Waianakarua, Trotters Gorge, and the South Branch of the Waikouaiti.

Rich, volcanic soils produced food crops for early Maori and now for farmers, despite the dry climate. Land use has tended towards more water-demanding activities, including dairying, since the late 1990s, with water quantity pressures, faced most acutely during dry and low-flow periods.

Oamaru dominates the main urban areas. The semi-rural areas have a mixture of residential activities, including retirement homes, lifestyle blocks, and medium-sized farm holdings.

In Kāi Tahu tradition, the creation of the Kakaunui (Kakanui) River relates in time to Te Waka o Aoraki, the shaping of the island and the stocking of the waterways and forests. Historically, this river was an essential part of the coastal trails north and south. It was also part of the seasonal trail of mahika kai, resource gathering, and hapū and whānau bonding.

There are surviving rock art remnants and rock shelters associated with these activities, which are a particular taoka of the area and give a unique record of the lives and beliefs of tūpuna.

Science Summary

Soils and land use

The North Otago FMU covers about 296,000 ha of land, including coastal margins to the north and east of Waitaki and Oamaru, the narrow coastal strip from Glen Creek to Waikouaiti river. Some major rivers within the FMU include Kakanui, Shag, Waikouaiti and Pleasant.

The main land covers in the North Otago FMU are high and low-producing exotic grasslands, exotic forests, and tall tussock grasslands. High-producing exotic grasslands are the dominant land cover, occupying approximately 44% of the North Otago FMU.

Dry-stock farming (58%) is the primary land use in the North Otago FMU. This is predominantly sheep and beef (45%); mixed sheep, beef, and deer (6%); beef (5%); and sheep farming (2%). Dairy farming occurs on approximately 12% of the FMU. Forestry and conservation estate occur in 7% and 6% of the area. The notable trends in land use change over the past three decades have been an increase in the extent of dairy farming (by 57%), forestry (by 67%), and conservation estate (by 117%). The area of dry-stock farming decreased by 12%. However, it remains the dominant land use activity in the North Otago area.

Brown soils are the most common soil type, covering 51% of the FMU. The land cover associated with this soil type is mainly high-producing exotic grasslands and forests. These occur in catchments such as Waianakarua and parts of Kakanui and Waikouaiti.

Pallic soils cover 40% of the FMU and appear in Waiareka Creek, Waikoura Creek, Awomoko stream, and parts of Pleasant river catchments. Pallic soils have permeability ranging from moderate to slow, and their drainage is generally imperfect.

Water Quantity

North Otago is sheltered from wind and rain from the west but is exposed from the east. Predominantly westerly quarter winds and rainstorms affect the west and south of the South Island but bring very dry conditions to North Otago which occasionally bring droughts especially in summer and autumn.

The less frequent storms bringing easterly quarter winds and rain to this region provide the occasional heavy rainfalls which can bring floods to the North Otago rivers and streams. A prolonged lack of these storms usually results in drought-like conditions in North Otago.

The main water use in this area is for irrigation especially in very dry seasons, and low flows can be significantly affected by this. The construction and operation of the North Otago Irrigation Scheme has slightly eased the low flow situation in the Kakanui catchment, especially the Waiareka tributary. This scheme, which abstracts water from the Waitaki River, has the capacity to extend further into, and south of, the Kakanui catchment and further ease pressure on low flows during dry periods. Extension of this Scheme into the Shag Catchment is currently not feasible.

Water Quality

Water quality in the North Otago FMU generally shows some degree of degradation. There is pressure from land use and, at times, from low flows. Rivers in dry catchments have less dilution and flushing capacity. They are more susceptible to high nutrients and other water quality pressures associated with high-intensity land use.

ORC monitors the water quality and ecology of rivers, streams, and lakes. When the results are combined, they can show the health of a water body, and long-term data is analysed to show trends in water quality over time. We have been monitoring some sites in this FMU for less than five years, so current water quality results are interim.

Fourteen of sixteen sites monitored did not meet the required standard for at least one measurement, according to the National Policy Statement for Freshwater Management (2020). Water quality is the most degraded in the Waiareka and Oamaru Creeks. Water quality at these sites does not meet the national bottom line for *E. coli* (faecal indicator bacteria), phosphorus and aquatic insect life (measured by the MCI - Macroinvertebrate Community Index). Oamaru Creek is significantly degraded and has the most 'D' band results, likely due to urban run-off. Aquatic insect life and *E. coli* results did not meet the national bottom line at about half of the monitored sites in this FMU.

Trend analysis for the North Otago FMU rivers showed some degradation at most sites, with many trends appearing in both the 20-year and 10-year analysis periods. The Waianakarua River and Waiareka Creek show likely degrading trends for nutrients, *E. coli*, and turbidity.

Groundwater

The North Otago FMU contains several different aquifer types, including confined, unconfined, and alluvial ribbons. Unconfined, shallow aquifers within this FMU include the Lower Waitaki Plains Aquifer, the Kauru-Kakanui Alluvial Ribbon Aquifer, and the Shag Alluvial Aquifer.

The Lower Waitaki Plains Aquifer does not have much irrigation demand because the Lower Waitaki Irrigation Scheme services the area. However, this aquifer has elevated nutrient loads, such as nitrate and DRP (dissolved reactive phosphorous), when compared to the NZ drinking water standards (DWSNZ, 2018; ORC, 2021).

South of Oamaru is the North Otago Volcanic Aquifer. This aquifer is heavily used for irrigation, domestic use, and stock water and is considered fully allocated. Our groundwater quality monitoring shows high nitrate concentrations and DRP (ORC, 2021).

The Kauru-Kakanui Alluvial Ribbon Aquifer and the Shag Alluvial Aquifer are ribbon aquifers highly connected to surface water. The high connectivity means contaminants in groundwater can affect surface water quality and vice versa. Groundwater use from these two alluvial ribbon aquifers is allocated against surface water.

Lastly, the deep, confined Papakaio Aquifer underlies a large portion of the northern section of the North Otago FMU. This aquifer is divided into a series of groundwater basins, with depths from ~10m to >400m deep. Some areas are under above-ground artesian pressures. The aquifer is hosted within Cretaceous-aged gravels and contains water dated to nearly 25,000 years old. Due to the old age of the groundwater and the naturally elevated iron, manganese, and dissolved reactive phosphorous, the water has limited appeal for domestic use, stock water or irrigation. The Papakaio aquifers are not available for further allocation.

Biodiversity

The North Otago FMU includes rare and threatened ecosystems and species. Rare and vulnerable ecosystems include braided rivers, ephemeral wetlands, tarns, lake margins, string mires, and wetlands. These ecosystems contribute to national biodiversity; however, land use change and invasive species often threaten them, and little is known about their extent or condition.

The North Otago FMU contains many species that depend on freshwater habitats and ecosystems, including fishes, invertebrates, plants, and birds. There have been 44 threatened freshwater-dependent species identified in North Otago FMU. The threatened freshwater fishes include Canterbury mudfish, lowland longjaw galaxias, Taieri flathead galaxias, and lamprey.

Threatened freshwater invertebrates include moths and a stonefly, with koura being at risk. Freshwater-dependent plants that are threatened include *Carex strictissima*, *Ranunculus*

ternatifolius, and *Myosurus minimus* subsp. *novae-zelandiae*. Many native birds depend on freshwater ecosystems as permanent or transient residents, including the threatened black stilt and black-fronted tern and the at-risk, black-billed gull. Information is often missing at a species level, particularly for freshwater invertebrates, non-vascular plants, and algae.

Exotic fishes include perch, tench, and three salmonids. Many native freshwater species are under threat and continue to decline in numbers.

Wetlands

Within the North Otago FMU, 17 sites are recognised as Regionally Significant Wetlands (RSWs). These are classified as swamp (8 sites), marsh (3), saltmarsh (3), and unclassified (3). Except for Red Bank Wetland Management Area (122ha) in the Macraes area uplands, all sites are coastal, mainly lagoons and estuaries associated with river and stream mouths. Five sites are grouped close to Karitane and the Waikouaiti Estuary, the largest being Waikouaiti River Estuary Wetland Complex (71 ha) and Hawkesbury Lagoon (43 ha). A further eight such sites are scattered along the coast to the north, the largest being Pleasant River (84 ha), Shag River (14 ha) and All Day Bay (11 ha).

The Pleasant River Estuary supports an extensive saltmarsh complex with marginal shrublands, a diverse range of bird species and an important poorly described invertebrate fauna. Other estuaries and lagoons along the coast include additional distinctive lagoon and estuarine habitats, depending on the behaviour of the rivers as they near the coast. Many of these are protected and part of active restoration programmes, while others are subject to regular livestock grazing.

Inland, several rare wetland habitats are found. The only inland RSW, Red Bank Wetland Management Area, has wetlands among snow tussock, shorter grassland, and shrubland. The wetter soils have red tussock grassland, schoenus fens, sphagnum moss land, and examples of ephemeral wetlands. Ephemeral wetlands are common and associated with uplands around Nenthorn on the ancient schist peneplain. Several threatened plant species (e.g. *Isolepis basilaris* and *Myosurus minimus* subsp. *novae zelandiae*) are associated with these ephemeral wetlands.

No wetland sites have been identified yet in the RPW from the Kakanui Mountains. Potential areas for further recognition are in the Dansey Ecological District, e.g., near Mt Stalker and Mt. Dasher. Wetlands in these uplands include copper tussock grasslands and cushion bogs.

Estuaries

There are four estuaries in the North Otago FMU, the Kakanui, Shag, Pleasant River and Waikouaiti. Modification and pressures vary from more intensive agricultural land use in the Kakanui to forestry and low-intensity agriculture in the other catchments. The estuaries cover a range of ecological conditions, and they are habitats for many wildlife, such as bar-tailed godwits, variable oystercatchers, flounder, and shellfish beds. ORC regularly monitors all the estuaries in the North Otago FMU.

The Kakanui estuary is a shallow, short-residence time tidal river estuary (SSRTE) that can close to the sea when flows are low. It is vulnerable to nutrients and shows eutrophication via macroalgal blooms, especially when flows are low, or the mouth is closed.

The Shag River is under stress from sediment and showing signs of nutrient enrichment with nuisance algae growth below the tide but not between high and low tide areas. The areas with high mud content are primarily in sheltered arms in the upper estuary and along channel banks and sheltered areas in the main basin. There is a large expansive salt marsh, and the estuary supports a variety of substrates; this, combined with the sediment issues, places the estuary in a “fair” condition for ecological health.

The Pleasant River estuary is more degraded than the other estuaries and has large areas of high enrichment conditions. It has nuisance macroalgae, high mud content and poorly oxygenated sediment, especially in the side arms and deposition areas. These are signs of sediment and nutrient stress. The indicators of estuary health in the Pleasant River range from “fair” to “poor”, except for the salt marsh. The salt marsh is still extensive around the estuary and in a “very good” condition.

The Waikouaiti estuary supports various substrate types, small high-value seagrass beds and extensive salt marsh areas, with a healthy cockle bed in the lower estuary. However, there are signs of sediment stress in the upper estuary with higher mud content in depositional areas and side arms. Low levels of nuisance macroalgae are present in patches indicating some nutrient stress is influencing the estuary.