



Taieri Freshwater Management Unit (FMU)

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Map: Taieri FMU (Freshwater Management Unit)



Introduction

The Taieri FMU (Freshwater Management Unit) encompasses the entire catchment of the Taieri River. The Taieri River is the fourth-longest in Aotearoa New Zealand, draining the eastern Otago uplands and following an almost circular path from its source to the sea. The Taieri FMU (Freshwater Management Unit) extends from Naseby to Mosgiel, the Lammermoor/Lammerlaws in the west and to Taieri mouth in the south. Notable freshwater bodies in the FMU include the Taieri River and its tributaries (e.g. the Kyeburn, Sow Burn, Deep Stream), Lakes Mahinerangi, Lake Waipori, and Waihola, and the Scroll Plain wetlands.

Mosgiel is the largest settlement in the Taieri, with a population of just over 13,000, followed by Ranfurly and Naseby in the upper Taieri.

Kāi Tahu used all areas of the Taieri catchment, with many mahika kai sites and settlements associated with the many waterways, lakes, and wetlands in the FMU. Due to resource use and development, many water bodies, such as Taieri Lake, are changed or lost.

Historically, European settlers used the Maniototo land for livestock as early as the 1850s. The gold rush created significant economic growth for the area around Waipiata and Kye Burn in the 1860s. A large wetland once covered the lower Taieri which has since been drained. The surviving wetlands of Lakes Waihola and Waipori are the remains of this extensive system.

Science Summary

Soils and land use

The entire Taieri River catchment is included in a single FMU and reaches from Taieri Mouth across the Taieri Plain into the Strath Taieri and Maniototo Basins. The catchment area includes all or parts of several mountain ranges. These are the Rock and Pillar Range (1450m), Lammermoor (1160m) and Lammerlaw (1210) Ranges, the eastern slopes of Rough Ridge (950m), the southern slopes of the Kakanui Mountains (1600m), the lower crests of Taieri Ridge (660m), and the Maungatuas (895m).

The largest urban area is Mosgiel in the southeast, with over 13,000 residents, followed by Ranfurly and Naseby in the north.

The Taieri FMU covers about 570,000 ha of land. The main land covers in the Taieri FMU are exotic grasslands, tall tussock grasslands and exotic forests. High-producing exotic grasslands are the most common vegetation and occupy ~35% of the area. These exotic grasslands are used for intensified grazing and are widely distributed across the FMU in regions such as Maniototo, Waipiata, Kyeburn, Middlemarch and the lower Taieri. Low-producing grasslands that brown off over summer, such as those found on steep hill and high country cover 27%, while tall tussock lands cover 22% of the FMU. Exotic forests occupy 5% of the Taieri FMU. They primarily occur in parts of the Waipori, Waihola, Riverside and Salisbury catchments.

Brown soils are the most common soil type, covering 48% of the FMU in areas such as Waipori, Parera, Salisbury, Leeflat, and Paerau. These soils mainly support the high and low-

producing exotic grasslands and exotic forests. Pallic soils cover 33% of the FMU and have variable permeability and generally imperfect drainage. Pallic soils occur in areas such as Shannon, Matarae, Kiteroa, Sutton, Middlemarch, Patearoa and Naseby. Parts of Maniototo and Patearoa have semi-arid soils, which cover 7% of the FMU. Recent soils, including alluvial floodplains of the Taieri river, cover around 6% of the FMU.

The most common land use in the Taieri FMU is dry-stock farming (71%). This is pasture grazing including sheep and beef (57%); mixed sheep, beef, and deer (8%); and sheep (6%). Conservation estate covers around 10% of the FMU, with forestry (5%) and dairy farming (4%) are present too.

Some notable changes in land use over the past 30 years have taken place. There has been an increase for dairy farming (31%), conservation estate (58%), forestry (7%), urban area (15%), and nurseries/vineyards/orchards (18%). Dry-stock farming has decreased by 8% but remains the primary land use in the Taieri area.

Water Quantity

The weather and climate of the Taieri Catchment are diverse, ranging from typical Central Otago conditions upstream of Sutton to cooler, wetter conditions in its lower reaches.

Upstream of Sutton, the catchment is sheltered by the Southern Alps from the westerly airstream, which drives much of the weather over New Zealand. Apart from the headwaters, the area is also sheltered from the southern and easterly quarters by hills and mountains.

As a result of this sheltering effect, the catchment upstream of Sutton, except for the Taieri headwaters, experiences typical Central Otago weather and climate conditions with generally hot, dry summers and cold, frosty, dry winters. Temperatures can range from

-13°C in winter to above 38°C in summer, and annual rainfalls range from about 1600mm in the Taieri headwaters to 400mm in the Maniototo Basin and the Strath Taieri.

Downstream of Sutton, the catchment becomes more exposed to the southerly and easterly quarter weather systems. Temperatures are much less extreme, and annual rainfalls range from around 1200mm on the coastal hills to between 600mm-700mm on the Taieri Plains.

The Taieri is an important water source for irrigation, and low flows are significantly affected during the irrigation season. Two hydroelectricity plants are operating in the FMU, one in the Upper Taieri and the other in the Waipori catchment. Most of the Dunedin City water supply is supplied from the Taieri River downstream of Sutton.

In its lower reaches, the Taieri River flows out onto the flat Taieri plains. It becomes tidal from around Allanton to Taieri Mouth on the East Coast.

Water Quality

Water quality in the Taieri FMU (Freshwater Management Unit) is generally good; however, some lower Taieri plain tributaries are degraded. Some sites here have among the poorest water quality in the Otago region. Water quality is affected by pressures such as intensive agricultural land use, urban land uses and stream modification. To check water health, ORC (Otago Regional Council) collects water quality and ecology data for rivers, streams, and lakes. We also analyse long-term data to find trends in water quality over time. We have monitored some sites in this FMU for less than five years, so some water quality results are interim.

About half of the 22 river monitoring sites did not meet the required national standard (National Policy Statement for Freshwater Management, 2020) for suspended fine sediment (visual clarity). Five sites in the lower Taieri did not meet the national standard for *E. coli* (human health indicator). Two sites, Taieri at Creamery and Owhiro Stream, did not meet the national standard for Dissolved Reactive Phosphorus. Excess phosphorus can cause algae growth and poor river health. Lake Waihola usually has 'C' band results for nutrients and chlorophyll-a (a measure of algae in the water). This result is consistent with the nutrient-enriched state of the lake, which has episodes of algal blooms.

Our trend analysis found most sites have some degrading trends. Degradation for nutrients, *E. coli* and turbidity (visual clarity) were calculated for most Taieri sites in our 20-year trend results. However, our 10-year analysis showed less sites with degrading trends for nutrients and improving trends for turbidity at most sites. For Lake Waihola, there were degrading long-term (18-year) trends for nutrients, *E. coli*, and turbidity. However, the 10-year analysis showed improving trends for turbidity and chlorophyll-a are likely.

Groundwater

The Taieri FMU has three aquifers: The Maniototo Tertiary, Strath Taieri, and the Lower Taieri aquifers. Groundwater can be used for domestic supply, irrigation, stock water, dairy sheds. However, the status and use of many bores in the FMU is unknown.

The Maniototo is Otago's largest aquifer by area. Groundwater in the Maniototo is found in two types of aquifer systems: shallow Quaternary deposits and deeper Tertiary sediments. According to the ORC database, there are 255 bores in the aquifer. Most bores are either <20m or 60-80m deep. We monitor groundwater quality in two bores, and the results show high nitrate concentrations and some *E. coli* detections. Some nitrate results were moving towards the nitrate NZ Drinking Water Standards Maximum Acceptable Value (MAV) of 11.3mg/L. Arsenic concentrations did not exceed the limits in these two bores. However, due to the prevalence of schist (a natural source of arsenic) in the area, it is recommended that bore users regularly test their water.

The Strath Taieri basin is between the Rock and Pillar Range to the west and the Taieri Range to the east. It is a tectonic basin formed by the faulting/folding of the Otago Schist basement rocks. The Strath Taieri basin has a single unconfined aquifer. This aquifer consists primarily of silty gravel but also has iron pans and silt lenses that form perched water tables, confined aquifers, and groundwater channels. The water table is shallow in most of the valley, at <5m below ground level, but is deeper to the west and beneath localised pockets of silt. There are 114 bores in the ORC database for the Strath Taieri basin. Groundwater quality in the Strath

Taieri basin is monitored in one bore. The results show several *E. coli* exceedances, which are likely to be due to poor bore security. There was one exceedance of the dissolved arsenic MAV. However, it may have been an isolated event and could be due to an analytical error. However, we recommend checking arsenic concentrations in this area. The highest nitrate concentration was 4.7mg/L, slightly below ½ of the MAV, although most samples range between approximately 1.0 and 1.7mg/L.

The Lower Taieri aquifer sits in a tectonic depression filled with large layers of sand, gravel, silt, clay, and peat deposits. A fine-grained, low-permeability estuary deposit covers approximately ¾ of the aquifer (the Waihola Silt-Sand). This layer formed when the basin was a marine bay. The groundwater is mainly recharged by rainfall and infiltration from the Taieri River around Outram, the Silver Stream, and the Waipori River upstream of Berwick. Most of the groundwater recharge is in the Mosgiel area, and the flow is westward to low-lying areas such as the West Taieri Drainage Scheme and the Waipori – Waihola Lake wetlands complex.

Our ORC database shows 552 bores in the Lower Taieri aquifer, although the status of many is unknown. Despite the high number of bores, groundwater use has fallen, particularly since the shutdown of the DCC (Dunedin City Council) groundwater takes. Many bore owners in the area do not use groundwater because the naturally high iron and manganese adversely affect the taste and colour of the water. The ORC monitors groundwater quality in four bores. The results show an increased risk of faecal contamination, with *E. coli* exceedances in three bores. Groundwater nitrate concentrations are all below the MAV of 11.3mg/L. However, some concentrations were over ½ the MAV (i.e., over 5.5mg/L). This is likely due to dairy sheds, septic tanks, and poor bore head protection. Sometimes nitrate leaching can be high but does not show in groundwater testing. This can be due to low-oxygen conditions, which break nitrate down. Dissolved arsenic concentrations were all below the MAV.

Biodiversity

The Taieri FMU includes rare and threatened ecosystems and species. Rare and vulnerable ecosystems include braided rivers, ephemeral wetlands, lake margins, salt pans, cushion bogs, and wetlands. These are often threatened by processes such as land use change and invasive species, with little known about their extent and/or condition.

Diverse species depend on freshwater habitats and ecosystems, including fishes, invertebrates, plants, and birds. There have been 72 threatened freshwater-dependent species identified in the Taieri FMU. Threatened freshwater fishes include the Central Otago roundhead galaxias, Taieri flathead galaxias, dusky galaxias, Eldon's galaxias, and lamprey.

Freshwater invertebrates include koura, shrimp, mussels, and threatened caddisflies, moths, stoneflies, and clam shrimp. *Cardamine mutabilis*, *Chenopodium detestans*, *Crassula peduncularis*, and *Triglochin palustris* are examples of threatened freshwater-dependent plants.

Many birds depend on freshwater ecosystems, permanently or as mobile residents, including the threatened Australasian bittern, black-fronted tern, and the at-risk marsh crake and black-billed gull. Information is often missing at a species level, particularly for freshwater invertebrates, non-vascular plants, and algae.

Exotic geese, willows and exotic fishes are found in the Taieri catchment including perch and four salmonids. Many native freshwater species are under threat and continue to decline in number.

Wetlands

Within the Taieri FMU, 33 sites are recognised as Regionally Significant Wetlands (RSWs) in the current Regional Plan: Water for Otago. These are classified as swamp (13 sites), marsh (8), fen (7), and inland saline (5).

The wetlands of Lakes Waihola and Waipori are the remains of the Taieri Plain extensive wetland system which has been drained in the last 200 years. Their area of 2,089 hectares include both lakes linked to the Waipori River by a bird's-foot delta of channels. These landforms were created by the tidal fluctuations of the river. . This wetland system, including Te Nohoaka o Tukiauau/ Sinclair Wetlands, is well known. Six much smaller ponds with swamp and willow margins are recognised as RSW sites on the Taieri Plain. Takitōa Swamp (68 ha), with flax, shrubland, and carex sedgeland, occupies the bed of a side valley at the top of the Taieri gorge.

The scroll plains of the upper Taieri are of quite different origins and character to the lower area. These wetland systems are still present on a grand scale. They hold the broad river meanders of the current river course as it wanders across the floodplains, along with ponded oxbows and old water channels which show the river's history. These scroll plains are recognised as special to Otago, and ORC is working on better understanding them to support their ongoing management.

Maungatua Summit Wetland Management Area (1213 ha) has cushion bogs, tarns, and tussock tops. Subalpine shrublands and beech forest remnants surround it on the east side of the range. To the west of Maungatua, and slightly lower, headwater fingers of the Pioneer Stream area drain north into Lake Mahinerangi. This area has the Loch Luella and Loch Loudon fen complexes (871 and 33 ha). These have a cover of copper tussock, sphagnum bogs and fens, and are surrounded by pasture. Similar remnants are found in the Black Rock marshes on slopes rising to the Lammemoors. To the north, on drier rolling hills west of the Silverpeaks, red tussock and moss smaller wetlands are present. The Peat Moss Hills (36 ha) and Lamb Hill (37 ha) wetlands are here. West again, several smaller wetlands are present in the Clarks Junction vicinity.

Ephemeral wetlands are scattered, and their flora and fauna are diverse, rare, and often nationally threatened. These wetlands can have various origins, for example, glacial moraines, dune hollows, oxbows, or sinkholes. But the characteristic type in inland Otago are surface depressions on the plateau crests of rolling schist country. These lack a surface outlet, so they pond in winter and spring when fed by rain, and snow melt. But in the drier months, they often completely dry out, encouraging a specific wetland flora and fauna for part of the year, such as low-growing turf vegetation. Examples of ephemeral wetlands in the Taieri FMU include Nenthorn Ridge (67 ha), Red Bank (122 ha), and the Styx (11 ha) Wetland Management Areas. At Taieri Mouth, there are estuarine communities and wooded wetlands (known as carrs).

Estuaries

The Taieri river estuary is a shallow, short-residence time tidal river estuary (SSRTE). The zone between high and low tide (intertidal area) is 9.96% of the estuary. While the Taieri river is not named as a Coastal Protected Area (CPA 22), it is important in terms of ecological, scenic, recreational, and cultural values. The estuary is susceptible to both nutrient and sediment stress. However, these stressors do not have much effect because of the small intertidal area, high flushing from the river, and lower light due to river depth. Only small patches of nuisance algae and mud occur along the edges of the water around rushes. There has been some historical reclamation of wetland areas, but the estuarine area is mainly intact, with large areas of rushland found along some margins.