Pomahaka River catchment

Land use, water quality, and ecological health investigation

Otago Regional Council

In December 2008, the Otago Regional Council (ORC) initiated an intensive investigation into water quality and ecological health in the Pomahaka River catchment, south-west Otago.

Why investigate water quality in the Pomahaka catchment?

The Pomahaka River in South Otago is highly valued by recreational users, and is recognised as a regionally significant trout fishery.

The area has a long history of agricultural use, and due to a wet climate, and heavy soil type, there is a reliance on artificial tile and mole drainage. Changes in land-use, especially by dairy conversions from sheep and beef farming, in the mid and lower catchment are putting pressure on the naturally high water quality.

This investigation aimed to get a better understanding of how different land-uses can affect water quality and in-stream ecological values.

Cattle in an unfenced Pomahaka River tributary.

What did the investigation involve?

Over a 14-month period, 10 water samples were collected monthly from 12 tile drains on land mainly used for dairy farming, and from nine tile drains from land predominantly used for sheep farming. Fifteen stream sites (including three control sites) were also sampled fortnightly for ten months. Water samples from the tile and mole drains, and the streams were analysed for nutrients (dissolved reactive phosphorus (DRP), total phosphorus (TP), nitrite-nitrate nitrogen (NNN), total nitrogen (TN) ammoniacal nitrogen (NH_4), suspended sediment (SS), and faecal bacteria (*Escherichia coli* (*E. coli*)). In the 2009-2010 summer, all streams had physical habitat, macroinvertebrate communities, and fish communities assessed to quantify the effect, if any, poor water quality was having on instream values.

Sampling sites throughout the Pomahaka catchment.

Electric fishing in the upper Heriot Burn.

A dense macrophyte mat that has proliferated in the Wairuna River (common in nutrient enriched waterways).

What did we find?

Tile and mole drain water quality

Dairy tile and mole drains had higher nutrient concentrations. Substantially higher concentrations of NNN, particularly during the winter, were probably due to lower grass growth rates not utilising the NNN that had built up in the soil. In turn, the highly soluble NNN was flushed out when soils became saturated during winter. DRP concentrations were also higher in dairy tile and mole drains during the spring and early summer. This could be explained by effluent being applied inappropriately on saturated soil. *E. coli* concentrations were mostly similar between dairy and sheep tile and mole drains. Both exceeded guidelines after rain. During dry periods, high *E. coli* levels were found in a dairy tile when effluent had recently been applied over the adjacent land.

Stream water quality

SS concentrations in the upper Herriot Burn, upper Waipahi River, lower Waipahi River, and the Wairuna are excessively high. These high values are likely to be the result of stock access, natural stream bank erosion during high flows, and channelised streams naturally claiming back their original morphology. DRP concentrations were above the guideline value in the Crookston Burn, Wairuna Stream, and Washpool Stream, with the latter two sites having excessively high DRP (probably as a result of inappropriate dairy effluent management). NNN concentrations were also well above the guideline value in all streams, except for the control sites. However, these values may be of less concern as they are at their highest during the winter when there is a low risk of prolific algal growth and during summer, algal growth is likely to be limited by DRP.

Turbid water in the Wairuna Stream during base flow in the middle of summer.

Coarse gravel substrate at upper Black Gully. This is what streams flowing through agricultural land can look like with good riparian management.

Ecological health

Fishery surveys revealed that poor water quality did not always result in degraded fish communities (such as in the Crookston Burn, which had poor water quality, but good trout communities). There are a number of streams that, with minimal improvements in land use management, could support excellent fish populations in the near future. Spylaw Burn, Leithen Burn, and Crookston Burn all had excellent trout populations, while the upper Black Gully site had excellent populations of native fish (primarily Clutha Flathead galaxiids).

The Washpool Stream and Wairuna Stream all had poor trout populations, and were the worst two sites in the entire catchment for fish values. The biggest threat to fish populations in this study was the impact of fine sediment through bank erosion (both natural and stock induced). This is because fine sediment smothers the habitat necessary for invertebrates (fish food) and fish. Sediment can also introduce phosphorus to streams, because it tends to attach to sediment. *E.coli* is harboured in fine sediments and is re-suspended during higher flows.

Streams such as the Heriot Burn, lower Black Gully, and Crookston Burn would all benefit from stream fencing and riparian planting.

Well-planted riparian buffers provide a range of ecological and aesthetic benefits.

Clutha flathead galaxiid (*Galaxias* Sp. D), which is a threatened native species due to predation by invasive species and habitat loss through fine sediment smothering habitat.

Where to now?

The findings from this study provide evidence that the current land use, and in particular high intensity land use, is adversely affecting water quality and instream values in the Pomahaka catchment. This information will be shared with the local community and discussed with farmers at local field days. Possible solutions, such as excluding stock and planting riparian vegetation, will be suggested. The information will also be used to aid future policy decisions within the ORC Rural Water Quality Strategy.

Similar intensive investigations will be also completed in areas of Otago with different soil types and climate, such as the Catlins, Manuherikia, Upper Taieri, and the Kakanui. This, along with ongoing information from SOE monitoring, will allow ORC to more accurately determine the ecological health of the waterways and identify specific issues that need addressing in different parts of the region.

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