

# High frequency water quality monitoring in Southland

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## ► Why high frequency

Environment Southland maintains a network of high frequency (c.a. continuous) water quality monitoring instruments for the purpose of characterising water quality parameters (subject to diurnal and seasonal variability), reducing uncertainty in load estimation, and better understanding sources of contaminants.

Sites are associated with hydrometric stations, and measure water temperature (25), specific conductivity (9), dissolved oxygen (6), turbidity (9), nitrate (5), and dissolved organic carbon (5).

Teledyne 6712 Automatic Water Samplers have been installed at 11 sites in order to collect validation samples during high flow events, and populate flow vs concentration rating curves.

The operation of the network requires a significant amount of time and effort from the Environmental Data team. The team carries out the installation, troubleshooting and regular maintenance of the instruments with the aim of providing reliable data.

## ► Typical installation

### Continuous sensors

Sensors are installed in the most suitable location for water quality measurement in accordance with the National Environmental Monitoring Standards (NEMS). Unique site characteristics demand innovation on the part of the technicians to achieve a high quality installation.

Catchment geology and geomorphology, flood level, macrophyte growth, and river bank processes all affect the final installation design.

The instruments are often housed in large PVC pipes which extend into the channel and protect the instruments from damage caused by debris (Figure 1). However, sediment accumulation in the pipes can influence the measurements, particularly after high flow events (Figure 2).

### Automatic samplers

Automatic Water Samplers mitigate the safety risk to the technical team during manual sampling of high flow. Samplers are placed on a concrete pad near the river channel and above potential flood waters height, or inside a container. The intake pipe is installed in the main flow, <1m from high frequency sensors to ensure a representative sample is taken, and sloping downwards so that no water or sediment accumulates in the pipe and contaminates the sample.

The automatic samplers are powered by battery which is recharged by a solar panel (Figure 3) or by mains power if available. After installation at a site, the automatic samplers are programmed to receive commands via SMS messages. The technicians must ensure that each sampler's modem has adequate reception to enable activation messages to be received, as well as calibrate sample volumes and suction hose lengths.



▲ Figure 1: Aparima River at Thornbury site showing the water quality instruments housed in the PVC pipes. The automatic sampler for this site is located inside the container.



▲ Figure 2: The result of significant sediment accumulation at the Waikaka Stream at Hamilton Park site.



▲ Figure 3: The automatic water sampler set up at the Waimatuku Stream at Waimatuku Township Road site. The automatic sampler is located under the barrel for protection and has a separate solar panel for battery recharge.

## ► Maintenance/data management

The telemetered data is checked in the morning by the Environmental Data team. Anomalies or problematic data can be indicative of issues with the equipment or the site; regular visual inspections can identify these issues, and a technician can be tasked to investigate or fix any problems.

One example is macro or micro bio-fouling of the turbidity sensors, which can be identified by erratic data or sensors' values gradually drifting upwards. Bio-fouling is easily remediated by cleaning the sensor, which ensures that longer-term erroneous data is avoided (Figure 4).

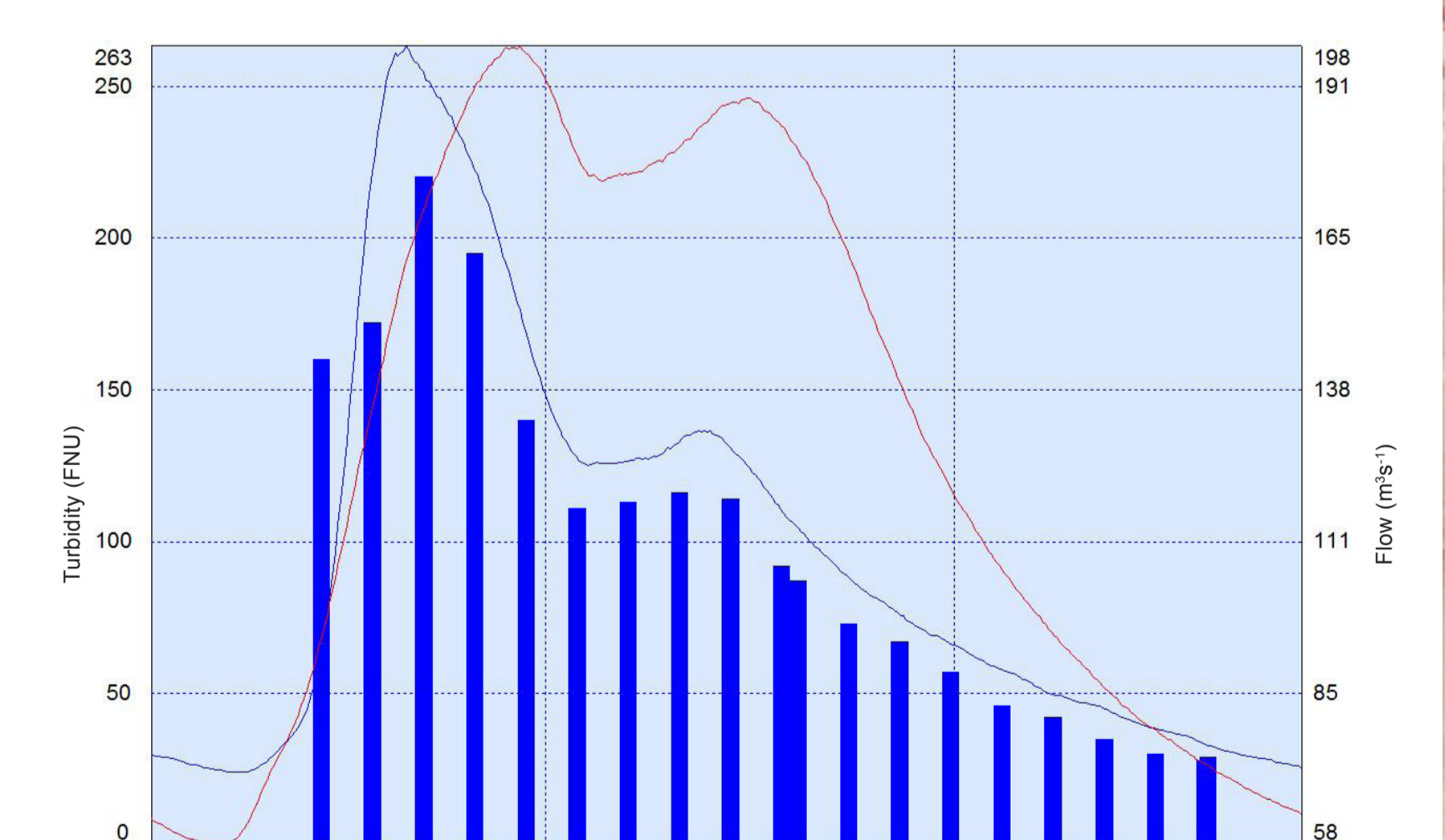
Maintenance and verification measurements are carried out at each of the sites on a monthly basis, to ensure the accuracy of the continuous water quality data. Handheld water quality meters are used to verify the conductivity, water temperature and dissolved oxygen values, and grab samples are taken to verify turbidity, SSC, and phosphorus and nitrogen concentrations



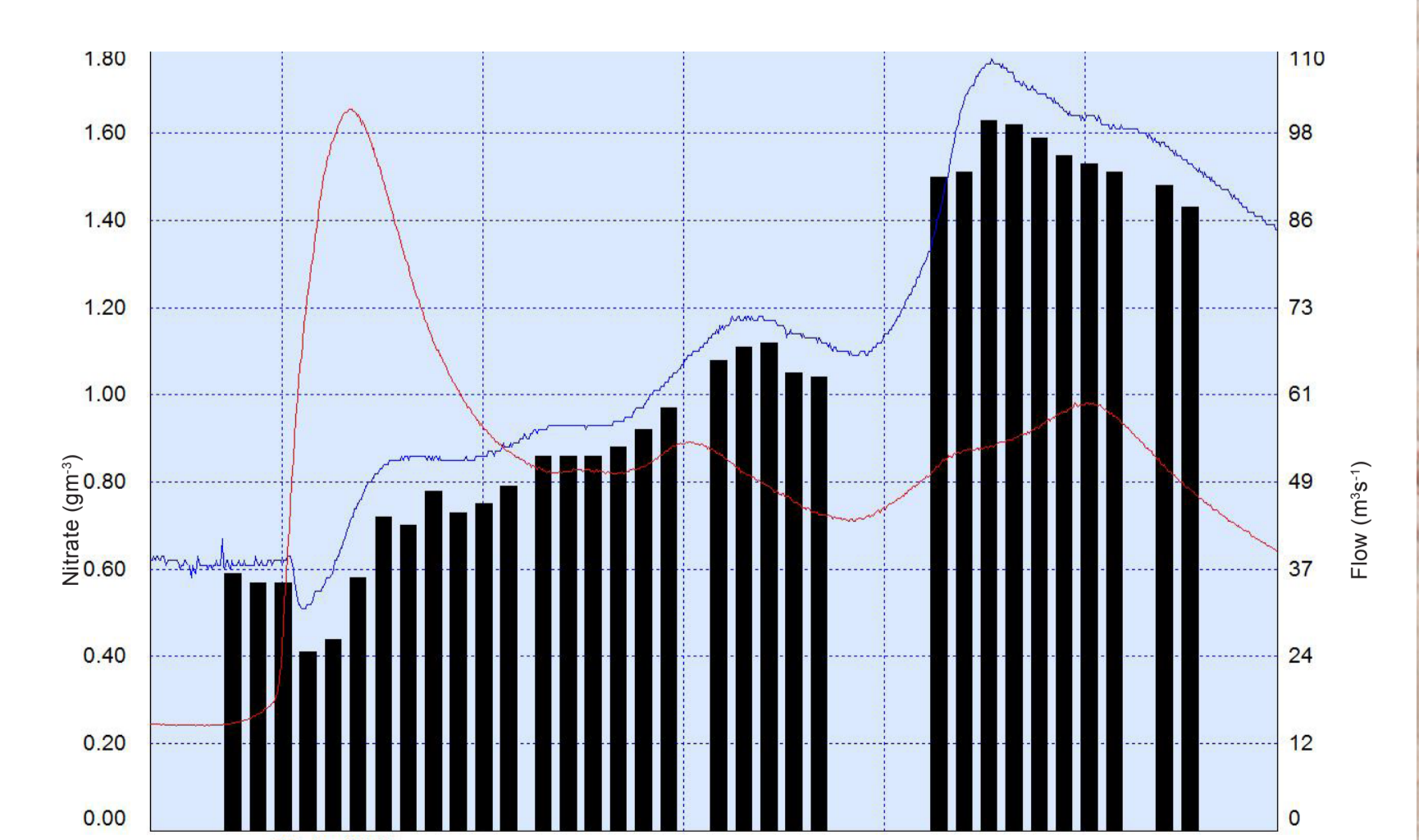
▲ Figure 4: Evidence of sensor drift due to bio fouling on the Hamilton Park turbidity sensor. The drop in recorded values is significant once cleaning of the turbidity sensor has occurred.

## ► Our experience so far

The implementation of the high frequency water quality and automatic sampler networks has enabled data to be collected by the high frequency instruments throughout high flow events. The high frequency measurements were able to be validated through laboratory analysis of the samples taken by the automatic samplers (Figure 5, 6). This data has already provided valuable insights into catchment responses, has been used to identify previously unknown trends, and will continue to provide important information in the future.



▲ Figure 5: Turbidity values from the automatic sampler (blue columns) and high frequency sensor (blue line) during a high flow event (red line) at the Aparima River, Thornbury site, 26 April – 1 May 2015.



▲ Figure 6: Nitrate values from the automatic sampler (black columns) and high frequency sensor (blue line) during a high flow event (red line) at the Aparima River, Thornbury site, 26 April – 1 May 2015.