Environment Canterbury
Regional Council
Kaunihera Taiao ki Waitaha

Water Measurement Systems

Flowmeters *Systems and requirements explained*
National Regulations *Industry guidance and standards*

Everything is connected

Selecting a flowmeter

There are a number of parameters to consider when deciding on what type of flowmeter to choose for a particular job.

Water source

This could be a river, surface water, groundwater, an open channel or pressurised pipe. The water source will affect water quality (silt and weeds), as well as the range of flow rates and head.

Head

- How much head is there?
- Do water levels fluctuate during a season and if so by how much?
- What is the minimum head required for a flowmeter?
- Do you need to minimise head loss?

Flow range

- What is the flow range throughout the year?
- What are the fluctuations in flow?

Most meters have a minimum flow below which they cannot provide an accurate reading. If you choose a large meter, you may lose accuracy at the lower end of the flow range. If meters are operated mostly in their high flow range they may wear out and fail more quickly.

Power access

When selecting meters (or dataloggers) for remote locations look for devices that can either operate without power, or can operate accurately on solar power or batteries.

Accuracy and reliability

Choose the flowmeter to match the required accuracy. Manufacturer's accuracy claims are usually backed up by laboratory and field testing.

Choose the flowmeter to match the required accuracy. Manufacturer's accuracy claims are usually backed up by laboratory and field testing. Under field conditions the flowmeter must have an accuracy of +/- 5%. In order to achieve this accuracy each flowmeter should be documented with a wet calibration carried out under laboratory conditions demonstrating an accuracy of at least +/- 2%.

Data output

- What level of data accuracy is required?
- What units do you need your data in?
- Does the flowmeter need to record instantaneous flow, totalised flow or both?

Installation

Refer to Fact Sheet No.1 for detailed information and to page 5.

Longevity

Flowmeters will need to be overhauled as a result of operational wear. The time between overhauls will depend on the device type and operating conditions.

Cost

Cost is an important consideration and in general more accurate and reliable flowmeters have a higher purchase price. Other costs are also an important consideration, however, and include installation, maintenance, data collection, verification and replacement.

The recommended approach is to develop a cost model, taking into account purchase and other costs, to assist with flowmeter selection.

Specifications	Electromagnetic Flowmeter	Mechanical Insert Meter (Paddle or Turbine)	Ultrasonic Flowmeter
Accuracy (laboratory)	+/- 0.15% - 2%	+/- 2% - 5% of rate	Better than +/- 2%
Reliability and tamperproof protection	Very high	Medium	High
Flow rate indication available	Yes	Yes - with datalogger attached	Yes
Remote reading capability	Yes	Optional	Yes
Average operating life before overhaul	20 years	4 years	15 years
Pressure loss (head loss)	Negligible	400mm (insertion type meter) Negligible (paddle type meter)	Negligible
Resistance to blockage	Very high	Medium	Very high
Resistance to weed	High	Medium	High
Relative installed cost	Medium	Medium	Low
Power required	Yes or solar/battery	No	Yes or Solar
Water quality	Can cope with silty water	Prone to wear with continued exposure to silty water	Can cope with silty water
Verification frequency	five-yearly	Two-yearly	Three-yearly (clamp-on)

Please note: The above table is a guide only, based on general information and manufacturer's literature where available. Contact the manufacturer for complete details.

Selecting and installing a flowmeter

The pros, cons and installation best practice.

Electromagnetic meter

An electromagnetic meter consists of a section of pipe with a magnetic field around it and electrodes to detect electrical voltage changes. When a conductive fluid passes through the pipe an electrical voltage is created in the fluid, proportional to the fluid velocity. Electrodes in the probe detect the voltages generated by the flowing water. Measurement of the voltage is then converted to velocity from which the flow rate can be derived for a given pipe section. This type of meter is produced in a range of standard sizes and flow capacities.

Advantages

- High degree of accuracy (+/- 0.15% - 2%) and consistent over full flow range.
- Wide flow range and no obstructions to flow.
- Robust with only minimal routine maintenance required.
- No moving parts.

Disadvantages

- Power supply required.
- Electronic components vulnerable to lightning damage.
- Repairs require skilled technician and specialised equipment.

Mechanical insert meter

An impellor is rotated by water passing through the meter, which is translated to a volumetric reading. The mechanism is calibrated by an adjustable device which is pre-set and security sealed. The meters are available in various sizes and the pipe has to be full of water during measuring.

Advantages

- Reliable and accurate means of measurement providing the meter is correctly installed.
- Relatively low initial cost.
- In-line maintenance with simple efficient mechanism.
- Headworks replacement readily available.

Disadvantages

- Difficult to detect malfunction or unauthorised interference to meter while operating, if operated without a datalogger.
- Prone to wear in silty water, potentially resulting in loss of accuracy.
- Some head loss characteristics.
- Frequency of verification.

Ultrasonic meter

Ultrasonic meters use transducers to measure water velocity in full pipe applications and convert this to a flow rate.

Transducers are fixed on the outside of the pipe, or inserted in the pipe, and use a transit time method to calculate the velocity of water within the pipe. The transit time method calculates velocity from the differences in time for an impulse to pass between two transducers located on the outside of the pipe.

Advantages

- Robust with minimal routine maintenance required.
- Simple to install and no moving parts.
- Same meter can be used in a wide range of pipe sizes.
- Consistent over full flow range.

Disadvantages

- Repairs require skilled technician and specialised equipment.
- Power supply required.
- Electronic components vulnerable to lightning damage.

Good installation

Installation

A flowmeter should be installed in accordance with Environment Canterbury's installation guidelines (Water Metering and Measuring Fact Sheet 1) to ensure it meets its design accuracy. Good installations leave a sufficient straight length of pipe between gate valves, elbows and the flowmeter to ensure that there is no turbulence in the water passing through the meter (turbulence reduces the accuracy of water meters).

Good Installation

To meet Environment Canterbury's guidelines and minimise flow disturbance meters should be installed with a minimum length of 10 diameters of straight pipe on the intake side of the meter and five diameters of straight pipe on the discharge side of the meter.

Meter too close to elbow. X

Meter too close to flange and gate valve, and insufficient straight length of pipe. X

Meter too close to control valve and gate valve. X

Flowmeter Installation

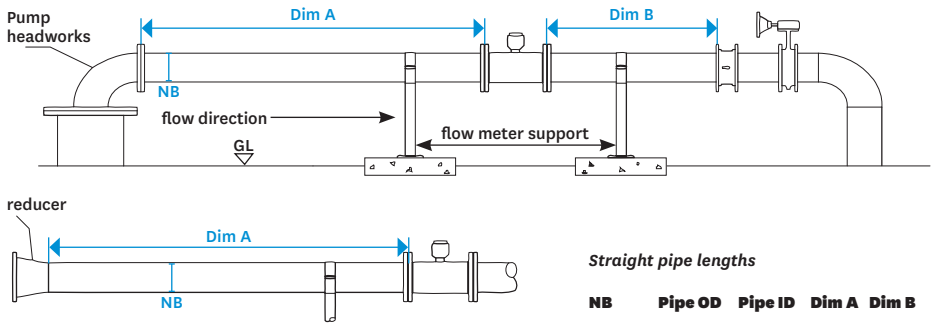
Environment Canterbury's requirements

A detailed plan of the installed meter and distances to any potential turbulence sources (e.g. elbows, valves) shall be submitted to Environment Canterbury within 30 working days by an approved installer.

- An independent verification of the installation (refer to Fact Sheet No.2) should be included.
- An Installation Commissioning Form and a Verification Form are available on www.ecan.govt.nz/watermetering .
- The flowmeter should be tamper-proof, or where unauthorised interference has occurred, it should be easily detectable.

Dataloggers

- The datalogger must provide more than 12 months worth of data logging at 60-minute intervals.
- The datalogger must be tamper-proof (or detect tampering if it does occur).
- Water use information from the datalogger must be submitted to Environment Canterbury in an agreed format at the completion of each irrigation season.
- Alternatively, a telemetered data logger (which records real time information) can provide the data and removes the need for manual downloading.
- Telemetered data logging systems are increasingly the preferred option as they become more cost effective.



Notes:
- all dimensions are in mm
- NB = nominal bore
- OD = outside diameter
- ID = inside diameter
- pipe ID is based on common available steel pipe sizes
- for sizes not listed use: - 10x ID for DimA - 5x ID for Dim B

Straight pipe lengths

NB	Pipe OD	Pipe ID	Dim A	Dim B
50	60.3	52.5	525	262
80	88.9	77.9	779	390
100	114.3	1D2.3	1D23	511
200	219.1	209.5	2095	1048
250	273	263.4	2634	1317

An example of best practice horizontal installation of a water meter.
For other examples refer to Fact Sheet No. 1.

National Regulations

The Government is introducing regulations on the measurement and reporting of water takes under section 360 of the Resource Management Act.

The National Regulations will affect existing and future water-take consent holders with takes of five litres per second or more. Water consent holders with takes below five litres per second will not be subject to the National Regulations. Also not affected are those with permitted water takes, individual household takes from reticulated water supply networks, or permitted stockwater takes.

The National Regulations will come into force 28 days after they are gazetted.

Water consent holders have between two and six years to comply, depending on the size of their take:

- For takes of 20 litres per second or greater – within two years of gazettal.
- For takes between 10 and 20 litres per second – within four years of gazettal.
- For takes greater than 5 and less than 10 litres per second – within six years of gazettal.

Environment Canterbury's programme for water metering suppliers

Environment Canterbury has a Canterbury-wide programme to provide guidance and set standards for the water measuring industry to align with the introduction of National Regulations for water metering.

The programme was initiated in the Rakaia-Selwyn area in 2009 and ran a 'Request for Proposal' process for water measuring service and technology suppliers. A Water Meter RFP Panel – comprising members from the Rakaia-Selwyn cluster groups, Environment Canterbury, and Irrigation NZ – evaluated the proposals.

A similar Canterbury-wide RFP process ran in 2010 with proposals again evaluated by the Water Meter RPF panel, expanded to include farmer representatives from throughout Canterbury.

The underlying principles of the programme are to ensure water metering services and technology are fit for purpose, are cost effective, and take into account future technological changes and improvements. As well as ensuring resource consent holders can install and operate cost-effective and reliable water measuring systems, the programme aims to reduce ongoing compliance costs.

A total of 71 companies submitted proposals in 2009 and 2010 with approvals granted in three categories: the supply of technology; installation services; or the supply of data hosting and compliance reporting services.

	Water measuring devices	Data logger/ Telemetry systems
1. Supply of Technology	19	24
2. Installation Services	17	20
	Data hosting services	**Compliance reporting services**
3. Data hosting & compliance reporting	14	8

The number of approvals in each category

For more information:
www.ecan.govt.nz/watermetering .

Information in this pamphlet is based on "Know the Flow - Flow Metering Training Manual" by the Australian National Committee on Irrigation and Drainage 2002.

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Environment Canterbury Regional Council

Everything is connected

Promoting quality of life through balanced resource management.

www.ecan.govt.nz

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