National Environmental Monitoring Standards

Glossary

Terms, Definitions and Symbols

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Change register

Version Number	Revision Date	Section	Topic	Revision Summary
1.0	Jul 2016			Initial release.
1.1	Sep 2016			
2.0.0	Jul 2019			
2.0.1	Nov 2019			
2.1.0	Sep 2022			
2.1.1	Mar 2023			
2.1.2	Jun 2024	Reformatted to align with new NEMS document style and format. Introductory pages reordered.		
		The National Environmental Monitoring Standards		Updated to standardised text.
		About this Glossary		Updated.
		Definitions	Key Words	New topic.
			Technical Terms	Amended “effective stage”, “instantaneous value”, “precision”, “recording agency”, and “synthetic data (record)”.
				“Normative reference” moved to Key Words.
				Added nine new definitions.
		Annex A	Bibliography	Reformatted. Added two new references.
2.1.3	Nov 2024	Definitions	Technical Terms	Added nine new definitions associated with Indigenous Vegetation Cover.
2.1.4	Jul 2025	Definitions	Technical Terms	Minor edits to definitions of terms associated with Indigenous Cover.
				Added 13 new definitions associated with Planktonic Cyanobacteria.
				Added other terms: spirit level, spirit levelling.
				Minor edits to other definitions: EDI and EWI.
2.1.5	Aug 2026	Definitions	Technical Terms	Added new definitions associated with Erodible Land and Mitigation. Added new definitions associated with Open Channel Flow

Table of Contents

The National Environmental Monitoring Standards iv

About this Glossary vii

Introduction vii

Objective vii

Scope vii

Formatting vii

Normative references ..... viii~~vii~~

Definitions 1

Key Words 1

Technical Terms 1

Symbols ..... 38~~32~~

Unit Abbreviations ..... 42~~36~~

Annex A – Bibliography ..... 45~~39~~

The National Environmental Monitoring Standards

The National Environmental Monitoring Standards (NEMS), and associated codes of practice, Glossary, and National Quality Code Schema can be found at www.nems.org.nz.

Development

The strategy that led to the development of these Standards and associated documents was established by Jeff Watson (Chair) and Rob Christie (Project Director) of the initial NEMS Steering Group, in 2014.

The NEMS initiative is supported by the Environmental Data Special Interest Group (ED SIG) (formerly the Local Authority Environmental Monitoring Group (LAEMG)), who contribute members to the NEMS Steering Group.

Implementation of the strategy is overseen by the NEMS Steering Group, which currently comprises Glenn Ellery (Chair), Jeff Watson (Technical Advisor), Phillip Downes, Rachel Herbert, Jon Marks, Charles Pearson, Jochen Schmidt, Michael Ede, Dan Elder, Abi Loughnan, Sonja Miller, and Raelene Mercer (Project Manager).

The NEMS Steering Group directs preparation of NEMS documents on authority from the Chief Executives of the regional and unitary councils and the Ministry for the Environment (MfE).

The development of these documents involves consultation with regional and unitary councils across New Zealand, major electricity generation industry representatives, research institutes, and organisations providing supporting services such as laboratory processing. These agencies together are responsible for the majority of environmental monitoring in New Zealand.

Implementation

Stationarity

NEMS Standards are intended for long-term monitoring programmes. Stationarity of record, whereby changes to methods and instruments do not introduce bias over the lifetime of the record, is an essential property (see also NEMS *Glossary*), without which a record cannot be confidently analysed for temporal trends.

Because the methods of collecting and processing environmental data do change over time, the Standards include provisions for identifying and mitigating potential loss of stationarity.

Data fit for purpose

To facilitate data sharing, the NEMS Steering Group recommend that NEMS Standards are adopted throughout New Zealand and all data collected be processed and quality coded in accordance with the methodologies described in the Standards.

The quality code is determined from the Standard adopted and applied at the time of data acquisition. The degree of rigour with which requirements of the Standards are applied may depend on the quality of data sought. The highest quality code (QC 600) may be assigned to data that meet the stated requirements for good data.

Data of lesser quality are accommodated but are assigned a lower quality code (i.e. less than QC 600). They may be fit for the current intended monitoring purpose but restricted in their use for a range of other current and future purposes.

Measured data coded as QC 500 (fair), or QC 400 (compromised) may be the best practicably achievable due to site limitations and/or transient lapses in data quality.

Health and safety

When implementing the Standards, current legislation relating to health and safety in New Zealand and subsequent amendments shall be complied with.

NEMS Codes of Practice (COP) provide additional guidance on health and safety issues and structural design. Use only the most recent published version of any NEMS COP.

Limitations

It is assumed that, as a minimum, the reader of these documents has an understanding of environmental monitoring and data processing techniques, and some competency in their application.

The documents do not relieve the user (or a person on whose behalf they are used) of any obligation or duty that might arise under any legislation, and any regulations and rules under those Acts, covering the activities to which these documents have been or are to be applied.

Instructions for manufacturer-specific instrumentation and methodologies are not included in NEMS documents.

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Funding

The primary funders of the NEMS project are Ministry for the Environment and New Zealand regional councils and unitary authorities.

Other financial and in-kind support to the overall NEMS project has been provided by the following organisations:

- National Institute of Water and Atmospheric Research Ltd (NIWA)
- Ministry of Business, Innovation and Employment – Science and Innovation Group
- GNS Science
- Genesis Energy
- StatisticsNZ
- Contact Energy
- Meridian Energy
- Mercury New Zealand Limited

Review

This document will be assessed for review within one year of its initial release and thereafter will be assessed for review approximately once every two years. Document status and proposed review dates can be found at www.nems.org.nz.

Feedback

If you wish to provide feedback regarding this version of the document, please provide it to https://www.nems.org.nz/feedback/.

About this Glossary

Introduction

A common vocabulary and set of symbols are essential to successful integration of the various Standards into a manageable quality programme, and to clear and consistent understanding and application of the requirements of each Standard.

This document was initially prepared by Marianne Watson (Hydronet Ltd) under contract to the NEMS Steering Group, and in collaboration with lead writers and working groups developing the various NEMS.

Subsequent versions of this document have been produced by Laura Keenan (Traverse Environmental) and the NEMS Technical Advisor in collaboration with lead writers and working groups

Objective

The objective of this document is to ensure a common vocabulary and symbology across the NEMS suite of documents.

Scope

This document includes definition of key words used in the NEMS documents, technical terms, explanation of acronyms, and a list of symbols not normally encountered in common usage. It also includes common-use terms that have specific meanings in environmental monitoring.

The terms, acronyms and symbols in this Glossary apply to all other NEMS documents and may appear in any of the NEMS applicable to the measurement of any variable covered by the suite.

Exclusions

The NEMS *Glossary* does not include comprehensive coverage of quality management terms that may be encountered in referenced documents. Where conflict arises between definitions in referenced documents and this Glossary, the definitions in this Glossary shall prevail.

Formatting

Variables are italicised when used in the NEMS suite of documents, but for readability, they are not italicised in this Glossary.

Normative references

There are no normative references applicable to this Glossary.

Definitions

Key Words

shall	Indicates a requirement, i.e., is mandatory.
should	Indicates a recommendation.
must	Indicates a mandatory instruction or expectation to fulfil a requirement.
may	Indicates a permission.
can	Indicates a capability or possibility.
note	Indicates additional information to enhance or clarify understanding.

normative reference A reference considered to be an indispensable and prescriptive part of a Standard that should be read and implemented in conjunction with the document containing the reference; in effect becoming part of the requirements of the Standard from which it is referenced.
Note: Normative reference should not be made to a document used only in preparation of a NEMS or intended only for information.

For example: The requirement "Turbidity sensors deployed in situ for continuous monitoring shall meet the ISO 7027:1999 Water Quality – Determination of Turbidity Standard." makes this ISO Standard normative for NEMS turbidity measurement.

Technical Terms

ABS (acoustic backscatter sensor) An instrument that measures the near-field intensity of sound back-scattered by suspended material within a single 'bin' (small sample volume) of water beside the sensor. (See also 'back-scatter').

absolute soil water content The weight of water per weight of soil; for example, grams of water/grams of soil.

absolute turbidity Turbidity data measured by a primary reference instrument, or converted from standard turbidity so that they are numerically equivalent to those measured by a primary reference instrument. The relationship applied is calibrated using paired measurements from the primary reference and in situ field instruments. (See also 'standard turbidity', 'calibration (of a relation or model)' and 'primary reference instrument').
Note: The converted data are stored as records of 'Absolute turbidity'.

accelerated erosion Erosion induced by human activities; in the NEMS *Erodible Land and Stabilisation Mitigations* it mainly refers to erosion initiated following forest clearance in hill country.

accuracy Closeness of agreement between measurements of a quantity and the quantity's true (unknown) value. Accuracy includes a combination of both precision and bias. (See also 'uncertainty' and 'observation accuracy').

acoustic profiler An instrument, either side-looking (measuring laterally across channel) or vertical-looking (measuring between water surface and stream-bed (or vice-versa)), that measures the intensity of sound backscattered by suspended material in water from a series of ranged 'bins', and usually integrated with acoustic current profilers, which use the Doppler shift of the backscattered sound to measure the current velocity. (See also 'ADCP' and 'backscatter').

ADCP (Acoustic Doppler Current Profiler) An instrument that uses acoustic signalling and Doppler principles to measure water velocity, direction, depth and boat speed when deployed periodically across a water body to perform a discrete discharge measurement (gauging), or to continuously measure acoustic back-scatter intensity when permanently installed submerged, either side-looking or up-looking, to provide a surrogate record for suspended sediment concentration. (See also 'acoustic profiler' and 'backscatter').

adequate protective vegetation Vegetative cover that provides protective value—a level of cover that is sufficient and extensive enough to achieve stability against all forms of soil erosion. The essential criterion is that vegetation – planted or reverting – has protective value, not that it be woody.

ADV (Acoustic Doppler Velocimeter) A family of instruments that use acoustic signalling and Doppler principles to measure water velocities. Some devices may be used as a current meter to measure point velocities during a gauging while others are deployed in situ to measure velocity continuously.

adjacent station (or site) A nearby site on the same water body, often operated by a different agency, that is sufficiently close to be recording the same or almost the same data. If the data are effectively the same, the adjacent station may function as the backup recorder.

adjusted intensity gauge data The rainfall intensity gauge data that have been rescaled to reconcile it with the primary reference gauge total.

AECV (Acoustic Echo Correlation Velocimeter) An ultrasonic instrument that measures the average water velocity through the entire depth of the water column

affiliated monitoring The collection of complementary data that inform on the variable of interest without being essential for correct measurement of the variable or for calculating derived measures from the variable. (See also 'associated monitoring').
Note: The complementary data may comprise observations, photographs, hydraulic data, or the sampling of other variables that may be influenced by the variable of interest, and they may be supplementary measurements or contribute to metadata.

afforestation The establishment of a forest or stand of trees in an area where there was no tree cover.

allocation (as in the NEMS *Indigenous Cover*) The allocation of polygons to the land cover classes within the LCDB. *Allocation accuracy* indicates the confidence level (Low,

Medium, High) that the land cover allocated to the LCDB polygon matches the land cover on the ground.

alpha A coefficient applied in surface velocity methods of discharge measurement, being the ratio between mean velocity and velocity at the water surface.

analyte A substance whose chemical constituents are being identified and measured. (See also 'variable').

anion-cation balance The balance within a water sample of the number of positively charged ions in solution (cations) and the number of negatively charged ions (anions). Calculated by comparing the total charge of the cations with the total charge of the anions.

anode An electrode at which electrons leave a cell and oxidation occurs. (See also 'cathode').

APHA method or **APHA equation** Method or equation listed in the reference textbook "*Standard methods for the examination of water and wastewater"* published by the American Public Health Association (APHA), the American Water Works Association (AWWA) and the Water Environment Federation (WEF).

archive rating A rating stored indefinitely as part of the historic hydrological record for a site; deemed to suitably define the relation, constructed using all possible relevant calibration data, quality assured, assigned a period of applicability consistent with the period of stable control it represents, and appropriately transitioned to prevent discontinuities being generated in the derived flow series.
Note: New data at any time, typically a new gauging of extremely high or low flow, may initiate review of and change to any or all archive ratings for a site, which may include adding new ratings and/or deleting ratings previously stored, or change to the period of applicability and/or transition period of a curve. The archive update process must ensure that no remnants of superseded curves remain in the data set nor unintended overlap of curves arise as they are applied.

archiving agency The agency that is responsible for data archiving, quality assurance and control for data sets.

assignment (as in the NEMS *Indigenous Cover*) Categorisation of land cover classes as either indigenous or non-indigenous. *Assignment confidence level* (Low, Medium, High) refers to confidence in the assignment as indigenous or non-indigenous.

associated monitoring The collection of supplementary measurements that are essential for correct measurement of the variable (e.g. non-vented groundwater head needing barometric compensation to provide groundwater level) or for calculating derived measures from the variable (e.g. load determined from concentration of the analyte and water discharge).

auto-sampler A sampling device that automatically collects water samples from a water body and stores them for later collection in an array of one or more sample bottles.

Note: Generally used to describe 'active' electrically driven auto-samplers, which pump a sample on a schedule that can be time-controlled or controlled via a data logger. 'Passive' auto-samplers are stationed in-stream and collect a sample as water level rises past the intake.

average recurrence interval (ARI) (or average return interval) (As used in the NEMS Water Level and other documents in relation to floods) The long-term average number of years expected between events as big or larger than the stated event. As an expression for likelihood of an event of a certain size (or greater), it is related to return period and annual exceedance probability (AEP).
Note: For 100-year or greater ARI, return period is equivalent and AEP is the inverse, i.e. a 100-year ARI event is equivalent to the 100-year return period event and has an annual exceedance probability of 0.01 or 1%.

averaging interval The period over which samples from a sensor are statistically summarised prior to logging the result as the value of the variable being measured. The statistic is usually the arithmetic mean but may be a geometric mean or median.

avulsing A term used to describe a river or stream prone to rapid abandonment of all or part of its channel in favour of formation of a new channel.

backscatter The diffuse reflection of waves, particles or signals back in the direction of their source.
Note: The measured acoustic backscatter intensity from suspended material in water depends on instrument design, sediment concentration, and sediment composition (notably size grade) hence its use as a surrogate for suspended sediment concentration once calibrated to the sediment composition.

backsight (BS) A reading 'looking back' along the line of progress to a position of known elevation when surveying. Since a survey progresses from a point of known elevation to points of unknown elevation, the first reading of almost any survey should be a backsight onto a fixed point of known elevation, usually a benchmark of some sort.

backwater Water held up or pushed back by some downstream obstruction to free flow. Also known as the backwater effect.

bankfull stage The level in terms of gauge height below which discharge is confined to the active channel and above which water spills onto berms and/or a floodplain.

baseline drift A continuous and gradual change in the measured background response.

bed load The coarser fractions of the stream sediment load that are too heavy to be suspended by turbulence but are tumbled, slid, or saltated (i.e. "skipped") over the bed by the near-bed current.

benchmark A fixed permanent reference point of known or assigned elevation used when levelling to determine elevation of other points in a circuit or traverse.

bias The systematic difference between true values and those values measured by an instrument or estimated by a predictive relation. Measurement bias (error) affects the accuracy of a measurement and is often due to the measurement process.

biofilm A thin resistant layer of micro-organisms; for example, bacteria and their secretions that stick to each other on a hard hydrated surface and may adhere or attach to the surface.

biofouling An accumulation of living organisms that has an adverse effect on measurements; for example, unwanted algae, on equipment such as a sensor lens.

biomass (as in the NEMS Planktonic Cyanobacteria) The living mass of the phytoplankton or zooplankton populations.

blank sample A water sample containing little to no analyte of interest, usually collected for instrument calibration or quality assurance purposes. Blanks may be collected in the field using de-ionised or distilled water under field conditions (field blanks) or in the laboratory (laboratory blanks).

blanking distance The area near the transducers of an ADCP in which no measurement is taken. Also known as the blank.

blue tick An accreditation program administered by IrrigationNZ.

bottom tracking An acoustic method used to determine boat speed and direction by computing the Doppler shift of sound reflected from the stream bed relative to the ADCP.

box coefficient A term commonly used in the United States to represent the ratio of the all-of-cross-section discharge-weighted sediment concentration to the sediment concentration of an index sample.

breakthrough curve A graph created when undertaking a salt dilution discharge measurement that shows the variation in tracer concentration over time at a monitoring point downstream of a salt injection.

bubbler An instrument used to measure fluid levels in streams, lakes, groundwater and tanks by way of sensing the pressure required to produce a constant flow of bubbles out the end of an air tube submerged in the fluid, against the pressure head of that fluid over that orifice.

bulk density The mass of the soil particles divided by the volume occupied by soil and voids in the sample.

calibration (of an instrument) The process of comparing the response of a measuring device or instrument (e.g. field meter) to known values of a traceable standard or standard solution of the variable of interest, over a defined range and in controlled conditions. (See also ‘standard solution’, ‘traceable standard’, ‘validation’ and 'verification'.)
Note: Results may indicate a need for repair or adjustment of the device or instrument so that it displays the correct reading when compared to the known values. Calibration is

repeated after servicing, when the device or instrument is in good working order, to demonstrate a proper response has been re-established ready for deployment.

calibration (of a relation or model) The process of estimating then adjusting the values of parameters, constants and coefficients in a mathematical or numerical model to best represent the real-world processes of interest and optimise agreement between observed data and the model's predictions. Agreement is usually determined by tests of goodness-of-fit. (See also 'validation').
For example: Calibration of relationships to transform relative measurements to their absolute form (e.g. soil water content and turbidity) or surrogate measurements to the target variable (e.g. stage to discharge or turbidity to suspended sediment concentration).

calibration range The range over which the calibration has been made.

calibration standard A traceable standard used for calibrating water and air quality instruments that may be a standard solution, or a suspension in the relevant medium. (See also 'standard solution' and 'traceable standard'.)

cathode An electrode at which electrons enter a cell and reduction occurs. (See also 'anode'.)

cease to flow (CTF) The lowest elevation of a hydraulic control below which water will be retained and therefore not flow.

censoring Replacement of a raw measurement value by the laboratory with a rounded value to take account of the detection limit (left censoring or <) or upper calibration value (right censoring or >) appropriate to the test method.

change point (CP) A point of fixed location and elevation used as a temporary reference when the survey instrument must be moved to sight additional points in a circuit or traverse; for example, a nail in a tree or fencepost, a mark on a curb, or a sturdy stake driven in an out-of-the-way area of a site. A CP is read first as a foresight, then again as a backsight after the instrument has been moved.

channel An open natural or artificial watercourse that periodically or continuously contains moving water.

check data A term used to describe reference values and their dates and times of observation particularly when applied to the verification and processing of logged data.
Note: For a water level series, the check data may be staff gauge or EPB readings; for a rain gauge, the check data are rainfall totals recorded from the primary reference gauge.

chemical fouling An accumulation of inorganic substances that have an adverse effect on measurements; for example, unwanted salts and oxides on equipment such as a sensor lens.

circuit In surveying, also known as a traverse. (See 'traverse'.)

clay Mineral grains that have a diameter less than 0.004 mm (4 μm). (See also 'mud', 'silt', and 'sand').

closing error The difference between the elevation determined by leveling and the expected 'known' elevation of the end-point of a survey. Also known as misclose. Closing error cannot be calculated for an open traverse. (See 'traverse'.)

comments file A metadata file associated with the data file that provides time-stamped descriptive information about the site and data.
Note: For a flow series, the comments file may include information about the gaugings, ratings and extreme flows.

commissioning agency The agency that initiates data collection.

complementary data Additional data collected from a site, or nearby, that are not required (e.g. for barometric or temperature compensation), but are useful to aid interpretation or analysis of the target variable. (See also 'supplementary data' and 'affiliated monitoring').

complex rating A relation intended to transform one variable to another, where the predicted variable is dependent on more than one input variable and/or may not be unique for a given input value.

composite samples Two or more discrete water samples mixed together to provide an average representation of a sampling location or time.

consent (resource consent) Authorisation granted under the Resource Management Act and Amendments to use or modify a natural or physical resource.

consent holder The person or entity who has been granted authority to use or modify a natural or physical resource (i.e. a resource consent) and to whom any associated regulations apply.

consenting authority An organisation charged under the Resource Management Act and Amendments with managing the resource consent process; usually a regional, unitary or territorial council.

contracted opening method An indirect method of estimating open channel discharge through a constriction such as a bridge, using hydraulic principles.

control The physical properties of a cross-section or reach of an open channel, natural or artificial, which determine the relationship between stage height and discharge at a location in the channel.

> **artificial control** A hydraulic structure, e.g. a weir or flume, installed in an open channel to create a cross-section of reduced area in order to induce critical flow through or over the structure. In most cases discharge can be derived from the upstream water level. In some cases it may be a pre-calibrated structure.
>
> **bed control** A structure installed in an open channel to create a section control and/or improve stability of the channel in the recording reach; for example, a timber weir or rocked grade control.
>
> **channel control** Where the relationship is governed by the geometry and features of a reach of channel, in almost all cases downstream of the recorder.

In the absence of confining structures, e.g. a bridge, high-flow controls are usually channel controls.

permanent control A natural or artificial control that remains unchanged for a long period of time.

section control Where the relationship is governed by the geometry and features of a particular cross-section downstream of the recorder; these are usually low-flow controls.

shifting control A section or channel control that changes form and/or location frequently due to mobilisation of the stream bed and/or banks in alluvial or sand channels, or cycles of material such as weed or ice accumulating.

control limit The upper or lower bound of expected variation in data of or from a process, determined statistically, and used to judge the significance of variation in the data and/or whether the process is operating satisfactorily.

Coriolis coefficient The ratio of mean of velocity head to theoretical velocity head used to correct energy equations if velocity varies across the section. Also known as the kinetic energy correction coefficient.

coverage factor A multiplier applied to a standard uncertainty to determine expanded uncertainty to a desired level of confidence.
For example: A coverage factor of 2 represents an interval of two standard deviations within which the true value might be found; that is, there is 95% probability that the true value is contained in the interval described by twice the standard uncertainty of the estimate. A coverage factor of 2 therefore provides for 95% level of confidence that the true value is contained within the expanded uncertainty calculated for the measurement result.

cross-section A specified section of a water body bounded by a straight line across the free surface and the corresponding wetted perimeter.
Note: For the calculation of area of discharge, the line across the free surface must be normal to the mean direction of discharge; that is, the shortest width across the flowing channel.

C-tick certification A third-party declaration of compliance with standards for performance with respect to radio frequency and/or electromagnetic interference.

CTD / Profiling CTD A water column profiling instrument that measures conductivity, temperature and depth.

current meter An instrument for measuring water velocity.

custodian The agency responsible for ensuring the preservation and dissemination of data.

CV (coefficient of variation) A statistical measure of the dispersion of measurement results around the mean.

cyanobacteria Blue-green algae. These are potentially toxic. They can adjust their depth in the water column using small gas bladders (gas vacuoles), and some species can use (i.e. fix) atmospheric nitrogen for growth when nutrient nitrogen in the water column is depleted.

daily manual gauge A type of a primary reference rain gauge; usually read at the same time each day.

data element One or more simultaneous values and their associated date and time, a chronological sequence of which constitutes a time series. (See also 'time series' and 'timestamp'.)

data filter A collective term for various methods of resampling, censoring, or statistically smoothing data for the purpose of reducing unwanted noise in the data. (See 'noise'.)

datum A reference level from which elevations are measured. It may be relative to some known level, e.g. mean sea level, or assumed. It should be used to determine elevation of station benchmarks.

DEM (Digital Elevation Model) A raster database of elevations.

depth The vertical distance below the free surface of a stream to a point of interest; for example, the position of a measuring instrument, or the bottom of the stream at any point on a cross-section.

depth cell or bin A truncated cone-shaped volume of water at a known distance and orientation from the ADCP transducers.

depth-integrated sample A composite sample collected over a predetermined part or the entire depth of the water column in a body of water.

depth-integrating sampler An isokinetic sampling device that, when traversed at a steady rate through a sampling vertical between the water surface and streambed and back again, collects a sample that is velocity-weighted. It has a concentration the same as would be obtained by integrating the product of local velocity and local concentration over the water depth.

depth profile samples A series of water samples or measurements taken at various depths from a body of water at a specific location; may be discrete or continuous samples.

derived data Additional time series computed from existing measured data (e.g. the time series of standard deviations of measurement bursts in each recording interval) or obtained by transforming the measured data (e.g. converting surrogate data to the target variable).
Note: Derived data can be produced on the data logger, by the data collection system, or by the time-series management or database system, often automatically, and can be virtual i.e. not written to storage.

DGPS (Differential Global Positioning System) An enhanced GPS system that uses a network of fixed ground-based reference stations to broadcast the difference between measured satellite ranges and actual satellite ranges to roving receivers.

diel Pertaining to a 24-hour period, particularly a regular daily cycle, that includes day and night, as opposed to a diurnal (day) or nocturnal (night) phenomenon.

dilution gauging A method of measuring stream discharge by introducing a known quantity of tracer, commonly salt (NACL), into the flow and determining how the tracer becomes diluted as it moves downstream.

discharge The outflow of a conduit or drainage basin, expressed as the volume of liquid flowing through a cross-section in a unit time.

discharge coefficient The ratio of actual to theoretical discharge, used to account for irrecoverable energy losses arising from the resistance to fluid flow posed by structures and equipment.

discharge rating A curve, equation or table that expresses the relation between the surrogate measured variable and the discharge in an open channel or conduit at a given cross-section.

discharge-weighted mean (or average) concentration The instantaneous load of an analyte or particulate passing through a nominated zone, divided by the corresponding water discharge through the same zone.
Note: The nominated zone may be a cross-section or vertical or unmeasured area. Units are mg/L or g/m^3, which are equivalent.

discrete sample A sample or set of samples taken from a body of water at a defined time (as opposed to continuous sampling). A discrete sample may be collected once, or regularly (e.g. weekly or monthly), or irregularly (periodically).

dissolved oxygen (DO) The amount of gaseous oxygen present in water.

drawdown The effective lowering of surface water or groundwater levels relative to the surrounding water body; for example, near the outlet of a natural or artificial structure**,** such as a dam or lake outlet, or the lowering of the water table caused by pumping of groundwater from a well.

drift A continuous and gradual change in the response from an instrument referenced to some known or demonstrably stable condition. (See also 'baseline drift').

earthflow erosion Slow movement of soil and associated regolith, usually along basal and marginal shear planes, with internal deformation of the moving mass. The original vegetated surface is characteristically hummocky and may contain numerous tension cracks. Movement rates vary from <0.5 m/yr to >25 m/yr.

Electrical Conductivity (EC) A measure of the water's ability to conduct an electrical current and is used as a surrogate for the concentration of dissolved ions in the stream.

edited data Data that may have been altered to minimise the effect of recording errors, and/or are adjusted as a result of validation and/or verification checks.

effective stage The height of the water surface above an orifice, stilling well intake, or other point of exposure of a sensor to the water body.
Note: For non-contact sensors mounted over water, the point of exposure is the water surface, so that effective stage for sensors that measure by reflection from the surface is always zero. For these sensors a proxy effective stage is used to determine verification tolerance. (See also 'verification', 'tolerance', and 'observation tolerance').

effective water's edge A position on a cross-section that is a boundary between flowing and non-flowing water.

electric plumb bob (EPB) See 'internal plumb bob'.

electrochemical sensor An instrument comprised of electrodes (anode and cathode, and possibly reference) housed in liquid electrolyte. When the substance to be measured makes contact with one electrode, a chemical reaction occurs that results in an electric current proportional to the concentration of the substance.

electrolyte A substance, usually a soluble salt, acid or base, that ionises when dissolved in a suitable solvent; for example, water.

electromagnetic Pertaining to the interaction between electricity and magnetism; specifically magnetism caused by an electric current, or induction of an electric current by changing a magnetic field.

elevation The vertical distance above a datum.

ensemble A single profile of the water velocity through the water column consisting of one or the mean of multiple acoustic measurements collected from an ADCP instrument.

epilimnion The upper water column in a thermally stratified water column.

equal discharge increment (EDI) A method of locating isokinetic sampling verticals at the centroids of sub-sections carrying equal portions of total water discharge.

equal width increment (EWI) A method of locating isokinetic sampling verticals at the midpoints of sub-sections of equal width.

erodible land Land identified as being at risk of mass movement or fluvial erosion based on physical factors, irrespective of current land cover or stabilisation mitigations. (See also 'Local erodible land data'.)

Erosion Susceptibility Classification (ESC) The system used in New Zealand to classify land vulnerability to erosion and regulate plantation forestry activities.

erosion terrain A reclassification of the New Zealand Land Resource Inventory Land Use Capability units into terrains with similar dominant soil erosion processes and severities.

euphotic depth Lower limit of phytoplankton growth in a water column, where light levels are 1% of surface irradiance.

euphotic zone The upper water column in which there is sufficient light for photosynthesis and hence phytoplankton growth.

exotic continuous-cover forest A forest that is deliberately established for commercial purposes, being at least 1 ha of continuous forest cover of exotic forest species that has been planted and will not be harvested or replanted, or is intended to be used for low-intensity harvesting.

exotic-dominant vegetation Vegetation where the canopy (aerial layer) is predominantly (>50%) comprised of exotic plant species that do not naturally occur in New Zealand.

exotic plantation forest A forest that is deliberately established for commercial purposes, being at least 1 ha of continuous forest cover of exotic forest species that has been planted and will be harvested or replanted.

exposure The degree to which the environment of a rain gauge's location affects its catch. The most significant influences are speed and distortion of airflow across the gauge and possible entry of additional water.

external staff gauge (ESG) A graduated scale mounted as permanently as possible either vertically or inclined in a water body, used to read water level in terms of the recording datum, in most cases as an independent check on an in situ sensor.

farm plan A spatial plan of soil conservation actions designed to reduce soil erosion on a farm, such as retirement of steep to very steep slopes, space planting of poplars on moderately steep slopes, afforestation of earthflows and gullies, and/or paired planting of poplars or willows on stream banks.

FAU (Formazin Attenuation Units) The units of turbidity assigned to readings from turbidimeters calibrated with reference suspensions of formazin. (See 'turbidimeter'.)

ferrous Of or containing iron, particularly as bivalent Fe^{2+}.

field calibrator A portable device used at site to independently validate performance of the in situ measuring instrumentation.

field capacity The water content held in soil after gravitational drainage from a saturated condition falls to a rate that is insignificant (i.e. drainage rate ≤ 1 mm/day).
Note: This is usually estimated in the field by measuring the soil water content two to three days after heavy rainfall, or by measuring the water content of soil cores in the laboratory after they have been equilibrated at a soil matric potential. In New Zealand, the laboratory estimation of field capacity is measured at the nominal −10 kPa soil matric potential, but direct field measurements show that it can vary between −2 kPa and −30 kPa, depending on soil texture.

field of view (FOV) The circular area visible when looking through a microscope.

firmware Software for hardware; for example, the control program embedded in a device.

flood A high river flow event that fully occupies the active river channel and may spill out onto the floodplain inundating land that is normally dry.

flow The movement of a volume of liquid. Used as a general term when referring to the movement of water, e.g. through a channel, and to the time series that results from applying a discharge rating to a record of stage. (See also 'discharge'.)

flow cell An enclosed vessel into which water is pumped, that also houses water quality sensors, to isolate the fluid from the surface environment and ensure minimal aeration.

flow meter (water meter) See 'water meter'.

flow rate (Q) Quotient of the actual volume of water passing through a water meter and the time taken for this volume to pass through the water meter.

> **minimum flow rate, *Q*1** The lowest flow rate at which the water meter is required to operate within the maximum permissible error.
>
> **overload flow rate, *Q*4** The highest flow rate at which a water meter is required to operate, for a short period of time, within its maximum permissible error, whilst maintaining its metrological performance when it is subsequently operated within its rated operating conditions.
>
> **permanent flow rate, *Q*3** The highest flow rate within the rated operating conditions, at which the water meter is required to operate in a satisfactory manner within the maximum permissible error.
>
> **transitional flow rate, *Q*2** The flow rate that occurs between the permanent flow rate, *Q*3, and the minimum flow rate, *Q*1, which divides the flow rate range into two zones, the upper flow rate zone and the lower flow rate zone, each characterised by its own maximum permissible error.

fluvial A collective term for processes in a river or stream associated with movement of sediment, and creation or alteration of landforms, by the action of the river or stream; that is, by erosion or deposition.

fluvial erosion The removal of material by channelised running water.

FNU (Formazin Nephelometric Units) The units used to report turbidity measured with instruments that meet the ISO 7027 Standard.

formazin A compound used to create reference solutions of suspended material that are used to calibrate turbidity sensors.

foresight (FS) A reading 'looking forward' to the next position along the line of progress when surveying. Since a survey progresses from a point of known elevation to points of unknown elevation, the last reading before moving the instrument during or at the end of any survey is a foresight.

FRE3 The frequency of flows greater than three times the median flow; used as an index of flow variability particularly with respect to the frequency of events likely to disturb periphyton accumulation (Clausen and Biggs, 1997). Usually an exclusion period of five days is applied from the end of each event before the next event can be counted.

fresh An elevated river flow event, occurring relatively often and large enough to carry a suspended sediment load but too small to be regarded as a flood.

full establishment The stage where a vegetation-based erosion mitigation measure has reached its intended functional maturity and provides structural reinforcement to the soil and regolith. This is generally achieved 10–15 years after implementation.

full flood extent The extremities to which water will spread at the conceivable highest stage.

full pipe flow Flow in a closed pipe or conduit that is full of water; that is, has no free surface.

full-scale error Absolute error divided by the measurement range of the device, often expressed as a percentage of full scale (%FS). The error is a fixed value and therefore less by proportion when the device is operating near its maximum range than when operating lower in its range. In contrast, error expressed as percentage of measured value (reading) (%RD) is the same proportion of the flow throughout the measurement range.

fully effective The state at which an erosion mitigation measure has reached its intended design strength and provides the maximum theoretical reduction in sediment yield for that erosion terrain.

fundamental erodible land Land that is classed as erodible without considering the presence of protective woody vegetation, including land that would be erodible if trees were removed, as defined by the fundamental HEL layer in the Highly Erodible Land model.

fundamental highly erodible land layer (fundamental HEL layer) National baseline dataset of land at high risk of mass movement erosion assuming no protective woody vegetation cover. Used in the national HEL model for deriving the HEL layer.

gauge height The water level measured at a water monitoring site, typically when read from a staff gauge. (See also 'water level' and 'stage or stage height'.)

gauging The physical act of measuring discharge. May also be used to refer to the combined result of the measurement, including the stage, date and time representative of the measurement.

GCP (Ground Control Point). GCPs provide the spatial reference required to transform image coordinates into real-world distances, allowing accurate scaling, rectification, and georeferencing of the recorded imagery.

geometric sequence A mathematical progression in which the ratio of successive terms is constant; for example, 100, 300, 900… .

GPS (Global Positioning System) A space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites.

gravimetric method A procedure for quantitative determination of an analyte by weighing the mass of collected solids.

gravimetric water content The mass soil water content relative to the mass of oven-dry soil; it is given in units of kg, kg^{-1} or other consistent mass units.

groundwater Water that occurs below the ground surface in the pore spaces between the grains of unconsolidated sediments (e.g. sand or gravel) and in the fractures of consolidated rock, within the saturated zone.

gullies Large, permanent landform features, > 60 cm deep and > 30 cm wide, formed by the removal of soil, regolith or rock by fluvial incision. Initially formed through the channelised flow of water, these features involve the headward and sideward migration of the channel.

height of collimation The elevation of the optical axis of the levelling instrument, determined by sighting onto a staff placed on a benchmark then adding the staff reading to the benchmark elevation. Also known as height of instrument (HI) or line of collimation.

HEL layer The national Highly Erodible Land spatial dataset derived from the high erodible land (HEL) model.

HDOP (horizontal dilution of precision) A measure of the geometric quality of a GPS satellite configuration that is a factor in determining the relative accuracy of a horizontal position. A smaller dilution means better accuracy.

height of instrument (HI) See 'height of collimation'.

high-frequency data Measurements obtained at sub-daily, and often sub-hourly intervals, usually from an instrument, and which may or may not be intended as a continuous record with interpolation valid between the measurements, i.e. all continuous data is high-frequency but not all high-frequency data is continuous.

highly erodible land (HEL) Land with no protective woody vegetation at high risk of soil mass-movement erosion (soil slip, earthflow, or gully).

Hill Country Erosion Programme (HCEP) A Ministry for Primary Industries programme – a partnership between central government and regional/unitary councils.

homoscedasticity When the error term is the same across all values of the independent variable(s) in a relationship, i.e. there is no systematic change in the spread of the residuals over the range of the measured values.
Note: Homoscedasticity is a fundamental assumption of ordinary least squares regression.

hydraulic mean depth (mean depth) The ratio of area to top-surface width of a cross-section.

hydraulic parameters The set of measurable factors that describe the behaviour of water when static and when conveyed in a pipe or channel.

hydraulic radius The ratio of area to wetted perimeter of a cross-section.

hypolimnion The lower water column in a thermally stratified water column.

hysteresis The dependence of the present state of a system on its previous states, usually resulting in a delayed response to changes acting on the system, and values of its physical properties that are looped or that lag behind the changing inputs.

implementation The physical act of applying an erosion mitigation measure to the land. This includes the physical planting of trees, the construction of stock-proof fencing for retirement, or the formal commencement of a reversion process.

independent validation Validation of data undertaken or overseen by an SCP who was not the original creator or provider of the works or data. (See also 'SCP'.)

index sample A sample, collected manually or by auto-sampler from a fixed point over the stream cross-section, usually beside the stream bank, that after calibration may be used to represent the discharged-weighted concentration for the whole cross-section.
Note: For suspended sediment, equivalence is achieved by applying a box coefficient.

index velocity method A technique for continuously estimating river discharge by relating a measured water velocity at a fixed location, known as the index velocity, to the mean velocity of the entire channel cross-section.

indigenous land cover Land cover that is dominated by naturally occurring substrate and/or indigenous vegetation.

indigenous-dominant vegetation Is vegetation where the canopy (aerial layer) is predominantly (≥50%) comprised of indigenous plant species naturally occurring in New Zealand.

indigenous planted forest Planted forest consisting of New Zealand indigenous tree species.

in-field plot data Quantitative data that have been collected in the field using standardised, repeatable, plot-based methods.

initial establishment The stage, typically one year after planting, where a plant has successfully survived its first full climatic cycle and is confirmed to have taken root.

in situ Deployed continuously on site at a fixed location.

instantaneous measurement A measurement or average of a series of measurements (or alternative central statistic, e.g. median or mode) spanning a period no greater than 20 seconds.

instantaneous value The result of instantaneous measurement, or the average of a series of measurements (or alternative central statistic, e.g. median or mode) spanning a period of less than 5 minutes that is taken to represent the quantity as a point sample at the instant of time that the value is recorded.

intensity gauge A rain gauge that provides a record of the onset, rate and cessation of rainfall.

intermediate (sight) (IS) Readings to determine elevation of additional points of interest aside from those that form the main traverse or circuit of a survey. Intermediate readings are not backsight-foresight pairs and therefore not verified unless observed twice from two different instrument positions during the survey, and are not used in the circuit close; that is, to determine closing error.

internal plumb bob A non-recording gauge that is normally used to measure the water level in a stilling well. Also known as an electric plumb bob or EPB.

invert The lowest part of the cross-section of a conduit or pipe, including an intake pipe, or the underside of a recorder housing.

isokinetic sampling When the water velocity entering a sampling device matches the ambient water velocity.
Note: This is important when sampling suspended sediment load to ensure efficient sampling of all size fractions, particularly the sand fractions.

Kainga primary reference gauge A type of a primary reference rain gauge.

kinetic energy correction coefficient See 'Coriolis coefficient'.

land cover The type of vegetation covering land (e.g. forest, pasture).

land cover classes The classification classes within the **LCDB** that describe land cover. Land cover classes are mutually exclusive and additive to 100% of the surface area of New Zealand. First-order classes are based on the physiognomy of the land cover (e.g. forest), with lower order divisions providing further information based on other characteristics such as phenology (e.g. evergreen) and floristic composition (e.g. broadleaved).

landslide A generic term for the movement of a mass of rock, earth or debris down a slope, under the influence of gravity. In the broadest sense soil slip, debris avalanche, debris flow, rock fall, earthflow, and slump are all types of landslide.

Land Use Capability (LUC) A systematic arrangement of different kinds of land according to those properties that determine its capacity for long-term sustained production. *Capability* is used in the sense of suitability and versatility for productive use or uses after taking into account the physical limitations of the land. (See also 'LUC Handbook').

LCDB (New Zealand Land Cover Database) A multi-temporal, thematic, and hierarchical classification of New Zealand's land cover that is periodically updated. The latest version of the LCDB and associated documents are found in the Land Resource Information Systems (LRIS) Portal (IRIS.scinfo.org.nz/). Land cover is classified into **land cover classes**.

Lidar / LiDAR A remote sensing technology that analyses light reflected from a laser-illuminated target to measure distance. Capable of producing high-resolution maps and 3-D images from which profiles and sections can be extracted.

limit of detection (LOD) The lowest quantity (often a concentration) that can be measured within a stated confidence limit. Also known as the method detection limit (MDL).

local erodible land data High-resolution spatial data collected at a sub-regional scale that identifies erodible land to refine or replace the national fundamental HEL layer.

logarithmic bias A bias that occurs when a function is fitted statistically to the logarithms of data and is subsequently re-transformed back to the original scale of the data.

logger volume The volume of metered water extracted, as recorded on the logger between verification visits.

LOWESS/LOESS (Locally Weighted Scatterplot Smoothing / Locally Weighted Smoothing) Non-parametric regression methods that combine multiple non-linear regression models to create a smooth line through a scatterplot. They are computationally intensive methods.

LUC Handbook (Land Use Capability Survey Handbook) A New Zealand handbook for the classification of land, 3rd Edition.

LUC Unit The most detailed component of the LUC classification. LUC Units group together areas where similar land inventories have been mapped, which require the same kind of management, the same kind and intensity of conservation treatment, and are suitable for the same kind of crops, pasture or forestry species, with similar potential yields.

macro-fouling Interference caused by solid objects snagged on or caught within a sensor or its housing, or invading a sensor's detection volume; for example, suspended debris, loitering aquatic animals, or growing in-stream vegetation.

mag flow or **magnetic flow meter** A meter in which a magnetic field applied to the metering tube results in a potential difference proportional to the flow velocity perpendicular to the flux lines. Also known as a mag meter.

Mass balance dilution gauging A method of stream discharge measurement based on the principle of conservation of mass, whereby a known mass of tracer introduced into a stream is balanced against the mass of tracer observed downstream after dilution within the flow.

mass movement Soil erosion processes involving failure at depth (> 0.5 m). It encompasses a wide range of erosion types where material moves down slope as a more-or-less coherent mass under the influence of gravity. Includes the erosion types: soil slip, earthflow, slump, rockfall, debris avalanche and debris flow.

metadata A set of data that describe and give information about other data. Metadata may describe the content, quality, condition, location or other characteristics of the data, and operations on or modifications to that data. Structured information that describes, explains, locates, or otherwise makes it easier to retrieve, use, or manage an information resource (data about data)

metalimnion The thermocline zone (of variable thickness) of a water column.

meter volume The change in incremental volume of metered water extracted between inspections, as derived from the meter display.

method detection limit (MDL) The lowest quantity (often a concentration) that can be measured within a stated confidence limit. Also known as the limit of detection (LOD).

metrological Of or pertaining to the science of all theoretical and practical aspects of measurement.

Note: Not to be confused with 'meteorological', the study of the atmosphere, especially weather and weather conditions.

monitoring agency The agency responsible for carrying out the monitoring that results in a given data set. (See also 'recording agency').
Note: A monitoring agency can also be the recording agency.

moving bed Of or pertaining to the mobilisation of sediments on or near the bottom of a river or stream.

MSL (mean sea level) The level frequently used as datum for traditional survey levelling of station benchmarks. True elevation of MSL varies around New Zealand and over time.

mud Mineral grains finer than 0.063 mm (63 μm). Includes clay grains (finer than 4 μm) and silt grains (4 μm to 63 μm). (See also 'clay, 'silt', and 'sand').

natural indigenous forest Indigenous forest that has not been planted, usually developing naturally following the retirement of land from production or reversion. (See also 'Retirement' and 'Reversion'.)

nephelometer A type of turbidity sensor that measures the light scattered back from suspended material in the water using a detector set to one side of the source beam (most often at an angle of 90°).

noise (noisy data) The excessive fluctuations in a variable's measurement results that alters or obscures the signal representative of the variable.
Note: Typically, the variability is high frequency, occurring between the values of consecutive samples, and is sometimes referred to as 'painting' or 'hunting'.

non-indigenous land cover Land cover that is dominated (>50%) by artificial and/or manufactured substrate and/or exotic vegetation.

non-volatile memory A computer chip that holds its content without power applied.

NPS-FM National Policy Statement for Freshwater Management.

NZDT (New Zealand Daylight Time) New Zealand (except Chatham Islands) summer time when clocks are moved forward 1 hour to UTC + 13 hours, to effect more 'daylight activity' hours. Usually begins around the first Sunday in October and ends on the last Sunday in April. Historically, different periods have applied. (See also 'NZST'.)

NZGD2000 (New Zealand Geodetic Datum 2000) The official geographic reference system for New Zealand, adopted in 1998, from which latitude, longitude and ellipsoidal height of any physical location are determined. It is compatible with GPS so positions between the two systems are equivalent for most practical purposes.
Note: Coordinates from GPS are generally referenced from the World Geodetic System 1984 (WGS84) or International Terrestrial Reference Frame (ITRF) global datum, which do not apply a tectonic plate deformation model and thus vary from NZGD2000 over time (up to 5cm/year since 2000).

NZLRI (New Zealand Land Resource Inventory) A national spatial database providing an inventory of five physical land factors – rock type, soil, slope, erosion, and

vegetation – which is used to create the Land Use Capability (LUC) rating for land across New Zealand.

NZMG (New Zealand Map Grid) The unique NZGD1949 projection, based on the New Zealand Geodetic Datum 1949 (NZGD1949) using the International 1924 reference ellipsoid, that provides the coordinate system used for the NZMS260 1:50,000 topographic map series, applicable for New Zealand except the Chatham Islands. NZMG was replaced by NZTM2000 in 2001.

NZST (New Zealand Standard Time) New Zealand (except Chatham Islands) normal time when clocks are set to UTC + 12 hours. (See also 'NZDT'.)

NZTM2000 (New Zealand Transverse Mercator 2000) A Transverse Mercator projection, based on NZGD2000 datum using the GRS80 reference ellipsoid, that provides the coordinate system used for the Topo50 1:50,000 topographic map series, applicable for the main New Zealand island group (North, South, Stewart and the smaller coastal islands) as formally defined in the Land Information NZ (LINZ) Standard LINZS25002. NZTM2000 replaced NZMG in 2001.
Note: Transformation of coordinates between NZMG and NZTM2000 is not straight forward, and it is not possible to have NZMG coordinates in terms of NZGD2000 or vice versa.

NZVD2009 (New Zealand Vertical Datum 2009) The previous official vertical datum for New Zealand and its offshore islands, referenced to the NZGeoid2009 surface, and formally defined in Land Information NZ (LINZ) standard LINZS25004. Replaced by NZVD2016 on 27 June 2016.
Note: NZVD2009 was the first nationally consistent height reference system for NZ.

NZVD2016 (New Zealand Vertical Datum 2016) The official vertical datum for New Zealand and its offshore islands, referenced to the NZGeoid2016 surface that relates normal-orthometric height, i.e. elevation of the land surface, to ellipsoidal height given by the NZGD2000 datum, and formally defined in Land Information NZ (LINZ) standard LINZS25009. From 27 June 2016, NZVD2016 replaces NZVD2009.
Note: Offsets are also defined to enable transformation of heights between NZVD2016 and 13 major existing local mean sea level (MSL) datums. In New Zealand, ellipsoidal height and sea level can differ by over 35 metres.

observation accuracy The maximum expected difference between the in situ sensor measurement and the traceable reference value; that is, the sum of the observation tolerance and the precision of the reference sensor.

observation tolerance The range of variance between in situ sensor and reference measurements that is permitted or which defines agreement.

octapent A type of primary reference rain gauge with a 5″diameter orifice and 8″ diameter receiver canister.

ODBC (Open Database Connectivity) A standard application programming interface (API) for accessing database management systems (DBMS) intended to be independent of database systems and operating systems and therefore make it possible for applications to access data from a variety of DBMS.

off-season The part of the year in which a particular activity, e.g. irrigation, reduces or ceases.

open channel flow The flow driven by gravity, exposed to the atmosphere in a conduit that does not completely enclose the fluid such as a canal, flume, ditch or race.

operational rating A rating stored indefinitely as part of an ongoing record of real or near-real time determination of flows for a site; deemed to suitably define the relation, constructed using best available calibration data at the time of determination, quality assured, and applicable from the date of publication forward.
Note: Operational ratings are often used to assess compliance with consent rules and may be required for evidence, so while possibly provisional they are rarely retrospectively altered. If new data indicate an existing operational rating should be amended, it is usual to implement the alteration as an entirely new rating so as to not disturb the integrity of prior compliance tests.

optical backscatter sensor (OBS) An instrument that measures the near-field intensity of light back-scattered by suspended material within a sample volume of water beside the sensor. (See also 'backscatter'.)
Note: Location of the sample volume depends on the instrument type and measurement protocol.

optical backscatter (point) sensor (OBS) A type of in-situ at-point turbidity sensor that measures the light scattered back from suspended material in the water at an angle greater than 90° (typically at 140° to 160° from the source beam direction).

optode An optical sensing device used to measure a specific substance, usually with the aid of a chemical transducer.

OURSIN Software developed to quantify the uncertainty associated with moving-boat ADCP discharge measurements

overall accuracy The combined uncertainty of all errors in a composite measurement, e.g. a gauging, or a result, e.g. a rated flow series.

over-ranging When an instrument returns a value outside of the range for which it is calibrated or designed to measure.

partially full pipe flow The flow driven by gravity in a closed conduit where the conduit is not full, and the flow has a free surface subject to atmospheric pressure.

peak clipping Failure to record the actual values of a measured variable in excess of some upper limit of the recording system; the data are truncated at the limit.

permanent wilting point The soil water content at which plants can no longer extract water from the soil and the plant is permanently wilted.
Note: The actual soil water potential at which permanent wilting point occurs varies between plant types, but in New Zealand it is nominally estimated in the laboratory by measuring the soil water content at –1500 kPa soil water potential.

phytoplankton Microscopic free-floating aquatic plants (algae).

pipe nominal diameter (DN) A sizing system for pipe based on its internal diameter. Also known as nominal bore (NB), and is related to nominal pipe size (NPS) in North America for diameters up to 12 inches.

pixel The smallest discrete component of a raster image or grid. In the context of the HEL layer, it represents the specific resolution (e.g. 15 m x 15 m) at which slope and rock type are modelled. (See also 'Raster'.)

POEM (Pressure Operated Electronic Meter) A depth and velocity measuring instrument that uses a forward-facing pitot tube on the front of a streamlined weight that houses velocity and depth sensors.

point-pair A coordinate pair of unrated and corresponding rated values that lie on the rating curve. An appropriately selected set of point-pairs and an interpolation method define a rating curve in most time-series software used in New Zealand.

point-sampler (point-integrating sampler) An isokinetic sampler that has a remotely controlled valve that allows a water sample to be collected at a discrete point (i.e. depth) in a sampling vertical. It may also be used to collect a depth-integrated sample over a discrete range of depth in the sampling vertical.

point velocity A sample of velocity measured at a specific location on the cross-section and in the vertical.

polygon Used in a general sense to define a unique spatial area in a GIS layer such as the HEL layer or local spatial data.

pool The part of a flowing channel with deep, slow-flowing water and a smooth water surface, usually where the stream widens and/or deepens, often on the outside of bends. (See also 'riffle' and 'run'.)

precipitation Any form of water in liquid or solid form falling from the atmosphere to the surface of the earth, including rain, snow, sleet, hail, drizzle and dew. Fog is not considered precipitation because the water is suspended.

precision Closeness of agreement between repeated independent measurements of the same quantity under specified conditions. Depicted by the random error in results of repetitions of the same test performed on the same sample. (See also 'repeatability' and 'reproducibility').
Note: The specified conditions may be those of repeatability or reproducibility such that precision is a broader term often used to define them (JCGM 2012).
Note: In "NEMS Measurement of Fluvial Suspended Sediment Load and its Composition" precision includes reproducibility.

primary reference gauge A gauge that allows measurement independent of the sensor and directly in terms of the measurement reference.
For example: A storage rain gauge deployed long-term at standard orifice height, or a staff gauge or electric plumb-bob with gauge zero in terms of the station datum.

primary reference gauge data One or more measurements from a primary reference gauge that is independent of the sensor. For rainfall, this data is often referred to as check gauge data. (See also 'check data'.)

primary reference instrument An instrument of a given brand and specification that is designated as a common reference for a network of deployed in situ instruments and/or a series of in situ instruments over time. Measurements, once in terms of the common reference, are comparable across the network and over time. (See also 'stationarity of record').
For example: A neutron probe used for field calibration of a network of soil moisture sensors or a specific brand of ISO 7027-1:2016 compliant turbidity instrument used for measuring or derivation of absolute turbidity.

procedure The series of ordered steps, i.e. the detailed method followed to execute a process. (See 'process'.)
Note: Procedure should be written down if it is poorly understood, or people are confused and/or interpreting it in different ways.

process A set of actions directed toward a defined end result (the objective). Process is related to procedure in that often, procedure is required to execute a process. (See 'procedure'.)
Note: Procedure is needed when process is lengthy, complex, routine but everyone must follow the rules, demands consistency, involves documentation and/or significant change, or has serious consequences.

processing (data processing) Quality control procedures applied to the data including actions that verify, validate, qualify, adjust and/or repair data, trace those decisions and actions, and record a summary of the decisions and actions with the data.

processing (laboratory processing) Functions carried out in a laboratory to obtain a measurement value, including one or more of preparation, measurement using a laboratory instrument, analysis, testing, identification, calculation of indices, and the quality control and reporting associated with each procedure undertaken.

profile A contoured vertical cross-section of a structure; for example, characteristics of a soil, distribution of temperature in a lake, or the velocity distribution of a stream, or the act of measuring that distribution. (See also 'velocity'.)

profile available water (PAW) The amount of water that a soil can hold for plant growth. It is defined as the water held in the soil profile between field capacity and permanent wilting point to a depth of 0.9 m, or to the potential rooting depth (whichever is the lesser). Values are weighted averages over the specified profile section (0–0.9 m) and are expressed in units of mm of water; for example, PAW 200 mm.

propeller current meter A current meter whose rotor is a propeller rotating around an axis approximately parallel to flow. Also known as a horizontal axis meter.

protective woody vegetation Vegetation with woody stems and branches that typically possesses woody roots capable of strengthening soils at the soil/regolith interface. In the HEL model, this includes planted and reverting woody species that significantly reduce the risk of mass movement erosion compared to pasture or non-woody cover. (See also 'Adequate protective vegetation'.)

provisional rating A phase of rating development where the relation is still being determined, and/or the curve lacks the required minimum evidence, and for which collection of additional calibration data remains possible under normal circumstances; that is, notwithstanding opportunity to measure a relatively rare low or high flow extreme that may then initiate review of all ratings for a site.
Note: A provisional rating may be altered and refined as new calibration data becomes available, thus flows derived from the relation may change after each iteration. Provisional ratings are therefore quality coded QC 200 'of unknown quality', 'not assigned a final quality code'. The code(s) for all or part of the rating range may be revised subsequently when the rating is adopted for the record.
Both operational and archive ratings may be provisional until deemed suitably defined (adopted), or until superseded by a subsequent rating shift that prevents collection of more calibration data representing the prior state of control.

pulse output A switch closure output from a meter or gauge that represents a set volume of water.

QC An abbreviation for quality control or, where followed by a number, an abbreviation for quality code. For example, a quality code of 600 may be referred to as QC 600.

QRev: USGS software for processing moving-boat ADCP discharge measurements using standardized algorithms, automated quality control, and uncertainty assessment.

QRevMS: Software for processing stationary (mid-section and mean-section) ADCP and ADV discharge measurements, providing quality control, discharge computation, and uncertainty estimation using the ISO and IVE methodologies,

QRevInt: An international open-source successor to QRev for moving-boat ADCP discharge measurements that incorporates advanced quality assessment, standardized processing algorithms, and uncertainty estimation including the OURSIN methodology.

quality assurance (QA) Checking to ensure procedures have been followed, so that an acceptable product is likely to be achieved.

quality codes A series of defined codes attached to the data that convey information about the quality of the data.

quality control (QC) Evaluating conformity of the product by testing it, or samples of it, against the specification.

quality control (QC) sample In a laboratory, a synthetic sample made from chemicals from a different source to those used for calibration, or a bulk sample that has been analysed many times to obtain control limits (e.g. bulked supply waters to provide a QC sample for fluoride analysis).

range of expected flow rates With respect to water metering, the range from minimum to maximum flow rates that the specific conduit would be expected to convey under normal conditions. The maximum expected flow rate is not limited to the maximum permitted flow rate, but to the capacity of the intake structure/system.

rainfall Precipitation that falls as drops greater than 0.5 mm in diameter.

rainfall intensity The rate of rainfall.

raster A data structure consisting of a grid of cells (or pixels) where each cell contains a value representing information.

rating A relation intended to transform one variable to another, or the process of determining and applying the relation.

rating change A major change in the relation between two variables necessitating a change in shape of the rating curve; that is, the new curve does not conform to the shape of an established 'family' or 'type'.

rating model The complete set of rating definitions and associated periods of applicability necessary and the rating interpolation and transition method(s) applied to transform a record at a site from one variable to another; for example, stage to discharge or flow to sediment concentration.

rating (curve) segment A contiguous portion of a rating curve with consistent shape and/or application over a particular range of flows; for example, can be described by a single equation, or is regarded as covering, for example, only the low flow range.

rating shift A minor change in the relation as a result of a relatively small change in stream bed and/or control level, where the overall shape of the rating does not change and the new curve conforms to the established 'family' or 'type'.

raw data Measurement values that are as first captured to a physical record, i.e., the data may be converted from raw signal to measurement units as they are captured but the data are not edited (see 'edited data').
Note: Raw data are a special case of original data. Original data must be defined by the recording agency (see section 3.1.1 of NEMS Processing of Environmental Time-series Data).

raw intensity gauge data The record of rainfall logged from the intensity gauge and sourced directly from the data logger.

raw measurement value Unadjusted or uncensored data; the value may be positive or negative.

reach A defined length of river channel.

receiver canister The receptacle within a storage rain gauge that holds precipitation and can be removed from the gauge.

recorder inspection Verification actions carried out at a site. (See 'site' and 'verification'.)

recording agency The agency responsible for archiving the data obtained by a monitoring agency. (See also 'monitoring agency').
Note: A recording agency can also be the monitoring agency.

recording zero Reduced level of zero gauge height adopted for the station.

reduced level (RL) The surveyed elevation above datum of a particular object or location.

reference point Objects at a recording station whose elevation above or below an adopted datum is known; for example, an electric plumb bob, external staff gauge, underside of recorder hut, etc.

reference thermometer Any thermometer used to perform a field check. This thermometer is validated against the traceable reference thermometer.

regatta A structured intercomparison exercise in which multiple discharge-measurement instruments and methods, such as Acoustic Doppler Current Profilers (ADCPs), Acoustic Doppler Velocity Meters (ADVMs), mechanical current meters, and other flow-measurement technologies, are used to measure the same flow conditions at a common test site.

relative concentration (slug injection method) The tracer concentration in the stream relative to the concentration of the injected slug solution. It is used to determine discharge from the dilution of a known tracer mass as it passes a measurement section.

relative error (or relative difference) The arithmetic difference between an observed and estimated value relative to the observed value, expressed as a percentage.

relative soil water content An estimate of the soil water content relative to the true soil water content. It normally refers to estimates of soil water content from remote sensing but may be used for uncalibrated data where only the relative changes in soil moisture content are of interest.

relevant regional council The regional council or unitary authority that granted consent to use or modify a natural resource under the Resource Management Act and Amendments.

repeatability Closeness of agreement between results of successive measurements of the same variable on the same sample under the same conditions of measurement. (See also 'precision' and 'reproducibility').

replicate samples Two (duplicate) or more samples taken under comparable conditions in time or space.
Note: Replicate samples are collected and analysed to establish the amount of variability in the data contributed by some part of the collection and analytical process.

reporting limit (RL) The lowest level at which an analyte should be reported, usually taken as twice the method detection limit (MDL).

representative sample A sample, collected from one point over the stream cross-section, that has a concentration (and size grading if SSC) that matches the discharged-weighted concentration (and size grading if SSC) for the whole cross-section. A representative sample is an index sample that requires no calibration.

reproducibility Closeness of agreement between results of measurement of the same variable on the same sample, carried out under changed conditions of measurement. (See also 'precision' and 'repeatability').
Note: Reproducibility represents the ability to replicate the findings of others. Example situations are controlled inter-laboratory test programmes, field regattas, or two

different technicians side by side measuring dissolved oxygen in the same water mass in the field.

residual A statistical term meaning the difference between an observed value and the corresponding value of the same variable when predicted by a function.

resistance temperature detector (RTD) A temperature sensor that operates on the measurement principle that a material's electrical resistance changes predictably with temperature. A constant current is applied and the voltage drop across the resistor is measured. For RTDs, the resistor is typically formed using pure metals. (See also 'thermistor'.)

resolution The smallest change in a measured variable that a particular instrument can detect and/or represent.

response time The time required by an instrument to respond completely to a change in input.

retirement The retirement of land from productive use (usually involving the exclusion of stock by fencing). This can include reversion to woody indigenous vegetation or planting of indigenous vegetation.

reversion The retirement of productive land (usually involving the exclusion of stock by fencing) to allow the re-establishment of indigenous vegetation, which may eventually develop into natural indigenous forest. (See also 'Natural indigenous forest'.)

riffle The part of a flowing channel of shallower depth and moderate to fast velocity over larger bed material, with mixed currents and a rippled and largely broken water surface. (See also 'pool' and 'run'.)

rotating cup current meter A current meter whose rotor is composed of a wheel fitted with cups turning on a vertical axis that is perpendicular to flow. Also known as a vertical axis meter.

roughness coefficient A factor representing the resistance to flow (largely friction) exerted by irregularities in the surface of the conduit or channel.

run The part of a flowing channel intermediate between, and often connecting, riffles and pools; with low to moderate depth, slow to moderate water velocity, uniform to slightly variable current, and a smooth-rippled unbroken surface. (See also 'pool' and 'riffle'.)

S Map Web-based soil maps on a site hosted by Landcare Research. (http://smap.landcareresearch.co.nz/home).

sacrificial anode A metal of more 'active' electrochemical potential attached to another metal object, such as a boat, that is consumed in preference to the object, thus inhibiting the object's corrosion.

salinity A measure of the concentration of dissolved salts in water.

sample A representative, small amount of substance collected from a larger body of the same substance, on which measurement of a variable(s) will be made.

sample splitter A device used to split a sample into sub-samples that have the same sediment concentration and size mixture as the original sample.

sampled zone The portion of a vertical that is sampled by a depth-integrating sampler.
Note: When depth-integrating samplers contact the streambed their intake nozzles are typically 10 cm above the streambed, so the sampled zone spans the depth between water surface and this point above the bed.

sand Mineral grains with intermediate axis diameters in the range 0.063 mm to 2 mm (63 µm to 2000 µm). (See also 'clay', 'mud', and 'silt').

saturation The degree or extent to which something is dissolved or absorbed compared with the maximum possible.

scan rate The frequency at which a data logger is able to, or is programmed to, measure and process signals from connected sensors then store the data received.

scatterers Suspended particles that reflect an incident beam of sound (acoustic instruments) or light (for example, back-scattering turbidity sensor). The incident and returned signals are compared for the purposes of measurement.

SDI-12 (Serial Data Interface at 1200 baud) An asynchronous ASCII serial communications protocol that was developed for intelligent sensory instruments that typically monitor environmental data.

seiche A wave that oscillates in lakes, bays or gulfs from a few minutes to a few hours, typically as a result of atmospheric disturbances; that is, water sloshing to and fro.

sensitivity The degree of change in a measured variable, induced or indicated by an object or feature, relative to either the background signal or the change in the actual variable of interest when the measured variable is a surrogate; for example, a control is sensitive if there is a relatively large change in stage for the corresponding increase in flow.

sensor A device that detects or measures a physical property and records, indicates or otherwise responds to it.

signal to noise ratio (SNR) A measure of signal strength relative to background noise, defined as the ratio of signal power to noise power.

significant figures The digits of a real number that are known with some degree of reliability and are therefore meaningful to expressing the quantity.

silt Mineral grains that have a diameter ranging between 0.004 mm and 0.063 mm (4 µm to 63 µm). (See also 'clay', 'mud', and 'sand').

simple rating A relation intended to transform one variable to another, where the predicted variable is dependent only on the other variable.

site The geographical location where monitoring takes place. (See also 'station'.)

site identifier A unique label for a site, which may be numeric or alphanumeric.

site inspection A collective term for at-site verification (recorder inspection) and/or checks of site integrity such as for the purposes of safety and upkeep. (See also 'site' and 'verification'.)

site number A unique numeric station identifier usually derived from a national numbering system such as Catchments of New Zealand or a map grid.
For example: site number 75207, where 752 = Clutha River, and 01 = Balclutha Station, or modified from a MetService Network Number; for example 941301 for C94131, Tarata.

site visit The act of going to and spending time at a site for the purposes of one or more of measurement, observation, inspection and/or maintenance. (See 'site' and 'site inspection'.)

slope-area method An indirect method for estimating river discharge by applying open-channel hydraulic principles to a measured channel reach.

slope threshold The slope angle that, when exceeded, indicates an increased risk of landsliding, particularly in the absence of protective woody vegetation, with its specific value varying based on the underlying geology and soil characteristics.

slug (or slug injection) A dilution gauging technique in which a known mass of tracer, most commonly salt (NACL), is introduced rapidly into a stream as a single "slug", or pulse.

SoE (State of Environment) monitoring A programme of observations intended to provide information about environmental conditions, trends and pressures.

soil horizon A distinct layer of soil that has a unique combination of soil attributes, different to the soil immediately above and below.

soil matric potential A measure of how tightly water is held in the soil. Water is held more tightly in smaller pores as the potential decreases (becomes more negative).

soil moisture content The mass or gravimetric soil moisture content is the mass of water in a soil relative to the mass of oven-dry soil and has units of kg, kg^{-1} or other consistent mass units. Alternatively, it can be defined as the volume of water per bulk volume of soil expressed as a percentage, or the depth of water per unit depth of soil.
Note: For the purposes of NEMS soil moisture and soil water are equivalent terms.

soil profile The combination of soil horizons to a defined depth of interest. In soil survey, this is typically to 1 m depth.

soil slip A type of rapid mass movement that involves the failure of a shallow surface layer of soil and vegetation, leaving a slip surface and a debris tail. Movement is initially by sliding or a combination of sliding and flowing, typically resulting in a failure surface <1 m deep that is planar and parallel to the ground surface. For the purposes of the NEMS *Erodible Land and Mitigation*, this term includes features locally referred to as earth slips.

sonde A complex instrument that continuously and unattended measures and records in situ a range of physical variables associated with water quality.

sounding The operation of measuring the depth of water from the free surface to the bed.

space-planted trees Trees (usually poplars) planted at spaced intervals to increase the strength of soil. Spacings vary depending on regional differences in climate, erosion type and severity, and the species used. Also referred to as pole-planted trees.

specific conductivity Electrical conductivity corrected to a specific temperature. *For example: 25°C for Parts 1 to 4 of the NEMS Discrete Water Quality Standards.*

spike Sporadic spurious high or low values in a time series; usually of no more than one or two successive logging intervals.

spin test An on-site reliability check of performance of a mechanical current meter to ensure the meter is rotating freely. The meter is held in a sheltered position out of the water, the rotating element set in motion manually (usually by blowing on it), and the duration timed until rotation stops.

spirit level An instrument that contains a sealed vial filled with liquid and an air bubble, which indicates whether a surface is horizontal (level) or vertical (plumb). (See also 'spirit levelling'.)

spirit levelling A surveying technique that employs spirit levels to orient the line of sight to coincide with the horizontal line in order to determine change in elevations. Spirit levelling is performed with an instrument that is a combination of a telescope and a spirit level vial.

SUNY (Salt UNcertaintY) A software application developed to quantify the uncertainty associated with stream discharge measurements made using the salt dilution method.

SSC (suspended sediment concentration) The amount of sediment present in a given volume of water, usually expressed in units of mg/l or the equivalent g/m^3, but may be reported in parts per million (ppm) by weight, which are equivalent up to concentrations of approximately 12,000 mg/l. (See 'suspended sediment'.)

stable channel A waterway contained between banks and bed that change very little over time; that is, the shape of bends and banks do not change and the bed is not subject to scour or deposition.

stabilisation mitigation Vegetation-based soil conservation mitigations including space-planted trees, afforestation, retirement and reversion.

stage-area relationship The relationship between stage height and cross-sectional area of the stream at or near the location where stage is measured.

stage-discharge rating curve The curve that results from plotting the relationship between stage height and discharge.

stage or stage height The elevation of the free surface of a water body relative to a known fixed datum. (See also 'water level' and 'gauge height'.)

standard error (of the regression) A measure of how well a model fits the data; specifically an estimate of the average error associated with predictions made using the model, calculated as the root-mean-square of the residuals.

standard solution A solution of precisely known concentration of an element or substance into which the sensor(s) of an instrument are immersed to perform calibration and/or validation of the instrument.

standard turbidity Turbidity data collected from any in situ instrument that is ISO 7027-1:2016 compliant (with the NEMS *Turbidity* permitted extension of instrument range) and standardised to factory specification. (See also 'absolute turbidity', 'FNU' and 'FAU').
Note: The data are stored as records of 'Standard turbidity' or 'Turbidity' in units of FNU, or FAU if measured by turbidimeter. Standard turbidity data collected in the field by different brands of ISO 7027 compliant instruments may show different values. 'Turbidity' data measured and stored in other units, e.g. NTU or FBU are not 'Standard turbidity'.

standpipe gauge A type of primary reference precipitation gauge; generally used without a receiver canister.

station The collective term for sensors at a particular site.

stationarity of record A property of the data whereby variation in the data over time is not a result of how the data were collected. It is achieved when variability in the measurements over time is only caused by changes, natural or man-made, in the environmental processes directly associated with the variable being measured.
Note: Complete stationarity, i.e. the absence of any trend or step-change however induced, is a fundamental assumption of some analyses such as frequency analysis, but may be impossible to assert, hence the need to record all known influences and events to enable data interpretation to take these into account.

step-change A break in the continuity of pattern of a data series, characterised by a sudden shift in value up or down between successive logging intervals, usually associated with some change in recording datum.

stilling well A chamber, usually a tower of one or more steel or concrete pipe sections, connected to the water body by a much smaller diameter inlet pipe. The intake dampens the effect of waves and surge in the main flow so there is a still water surface in the chamber on which the float can ride.

storativity The volume of water released from storage with respect to the change in water level (head) and surface area of the aquifer. Also known as the storage coefficient.

suitably competent person (SCP) A person with the appropriate skills and experience to undertake an assessment or supervise others to undertake an assessment.

suitably qualified hydrologist A hydrologist with no less than five years of relevant practical experience and trained in the practical aspects of open channel flow measurement.

supersaturation When dissolved oxygen of the water body is greater than for atmospheric equilibrium.

supplementary data Additional data required to be collected simultaneously from a site, or nearby, for measurements of the target variable to be accurate. Usually, these data permit compensation for method interferences. (See also 'complementary data' and 'associated monitoring').
For example: Supplementary barometric pressure data collected for barometric compensation of values obtained from an unvented groundwater level transducer that is registering absolute rather than gauge pressure.

surface velocimetry A non-contact method of measuring stream discharge by determining the velocity of features moving on the water surface, such as naturally occurring tracers, turbulence patterns, foam, or purposely introduced particles, using video imagery, photographs, or radar-based sensors.

suspended load The part of the stream sediment load that is suspended within the flow by turbulence and is carried downstream by the current. (See also 'wash load').

suspended sediment Mineral sediment grains suspended in moving water by turbulent eddies.

suspended sediment concentration (SSC) The mass of sediment in a unit volume of water (mg/l, equivalent to g/m^3), measured by filtering the entire field sample. (See also 'total suspended solids (TSS)').
Note: SSC is more reliable than TSS when rapidly settling particles, e.g. sand, are present.

suspended sediment gauging The physical act of measuring, usually by depth-integrated sampling at multiple sampling verticals, the suspended sediment load passing a cross-section, and from that and the water discharge, the discharge-weighted (cross-section mean) suspended sediment concentration (SSC_{Qm}). May also be used to refer to the combined result of the measurement, including the stage and/or water discharge, and date and time representative of the measurement.

suspended sediment load The mass rate at which suspended sediment is transported through a river or stream cross-section. Usually reserved for the instantaneous load (kg/s) derived from the product of concentration in g/m^3 and flow in m^3/s. Time-averaged loads are distinguished by qualifiers, e.g. daily load (t/day); annual load (t/year); mean annual load (t/year).

suspended sediment surrogate Some instrument-measurable property of a stream that relates to its suspended sediment concentration, and hence can be used as a proxy for suspended sediment concentration once a calibrated relationship has been established.

suspended sediment yield Suspended sediment load integrated over some specified period of time. May be expressed as a total (in kg or tonnes), or as a mean for the period per unit area of the catchment upstream from the measurement site (usually reported as t/km^2/year ($t/km^2 \cdot yr$) but sometimes as t/ha/year (t/ha·yr)).

synthetic data (record) A period of time series data in which values are estimated from relationships, indirect calculations, and/or limited measured data, typically created to fill a gap in a continuous time series of measured data.
Note: Values obtained by direct calculation from measured data, e.g. total nitrogen, or barometric compensation of dissolved oxygen, are not synthetic in the context of NEMS.

target characteristic The variable to be observed and its spatial and temporal resolution.

telemetry A system of automated measurement and transmission of data from a network of remotely deployed instruments to a centralised data management facility.

temperature compensation Generally, the adjustment of measurements to minimise or eliminate the influence of changes in water temperature on the measured values, and may be done in the instrument. Specifically, for water quality variables, adjustment to a common temperature, e.g. pH and conductivity to 25°C (NEMS Discrete Water Quality Parts 1 to 4).

thalweg A line joining the lowest points down a length of stream bed or valley, thus defining the deepest channel and therefore marking the natural direction; that is, the profile, of the watercourse.

thermal response The time needed by an instrument or device to reach a desired threshold of temperature change; for example, achieving equilibrium with the contact fluid.

thermal stratification Separation of a water column into two layers by temperature (warmer water on top).

thermistor A type of resistor, usually ceramic or polymer, whose resistance varies significantly with temperature, more so than in standard resistors. (See also 'resistance temperature detector (RTD)'.)

thermocline The boundary zone or temperature gradient between the two layers in a thermally stratified water column.

time series A set of values measured sequentially at successive intervals of time (not necessarily regular) and for which the chronological ordering is an essential characteristic of the resulting data.
Note: The essential characteristic of a time series is that the observations are ordered by, and can be analysed against, time. This differs from other data sets that are ordered against some other property (such as magnitude) or no property at all (random observations).

time-series manager (TSM) A database management system optimised for time-series data. Variable values are stored as a sequence at known intervals of time (not necessarily regular), are indexed by time, and able to be analysed with respect to time.

timestamp The date and time of a time-series data element. (See also 'time series' and 'data element'.)

timestep The time interval between successive timestamps. (See 'timestamp'.)

tolerance See 'observation tolerance'.

total suspended solids (TSS) The mass of sediment in a unit volume of water (mg/l, equivalent to g/m^3), measured by filtering a volumetric sub-sample of the field sample. (See also 'suspended sediment concentration (SSC)').
Note: TSS is not as reliable as SSC when rapidly settling particles, e.g. sand, are present.

totaliser A device that computes and displays a running tally of some incremental activity.

traceable reference thermometer A thermometer that has a unique identifier and a valid certificate documenting its calibration against another traceable reference thermometer.

traceable standard A primary reference measure of the quantity of interest, maintained by a national standards body and related to the measurement results from an instrument or device by an unbroken chain of comparisons. For New Zealand the standards body is the Measurement Standards Laboratory of New Zealand (MSL).

transect One sweep across a water course from one bank to the opposite bank with an ADCP on a moving boat.

transform A process within time-series software that enables data to be modified with respect to values or time or both.

transformation matrix An array of functions used to convert vectors from one coordinate system to another.

transmissivity The rate at which water moves horizontally through the entire thickness of an aquifer, being a measure of the amount of water that may be delivered to a pumped well. It is determined usually by pump test with results expressed as the flow through an aquifer section of unit width under unit hydraulic gradient.

traverse A line or path of travel along which survey stations are placed so previously surveyed points may be used as a base for observing subsequent points. A closed traverse either ends (closes) back at its starting point, or begins and ends on stations of known positions. An open traverse does not close on either itself or a station of known position. As such, an open traverse does not provide any means for checking for errors and mistakes so should generally be avoided. Also known as a circuit.

Trophic Level Index (TLI) An index that gives an indication of lake water quality, using four variables: chlorophyll *a*, total nitrogen, total phosphorus and water clarity.

tunnel gully erosion Erosion initiated by the subsurface concentration and flow of water, resulting in eluviation and scouring and the formation of narrow conduits, tunnels or pipes. Soluble, dispersive or low-strength material is removed, ultimately resulting in collapses, visible either as holes in the land surface or as gullies when sufficient collapses coalesce to form continuous linear features.

turbidimeter An instrument that measures the turbidity of water by determining the attenuation of a beam of light between its source and a receiver due to material suspended in the water. (See also 'turbidity' and 'turbidity sensor').

turbidity An optical property of a solution; the degree of loss of transparency, i.e. cloudiness, caused by the effect of suspended particulate and colloidal material.

turbidity sensor An instrument that measures light scattered by suspended material in water. The measured turbidity depends on instrument design, sediment concentration, and sediment composition (notably size grade); hence it may be used to provide a surrogate record for suspended sediment concentration once calibrated to the sediment composition.

turbulence The space-time variability in water velocity caused by three-dimensional eddies.

uncertainty An estimate of accuracy. Express as expanded uncertainty, i.e. as an interval about the result, at a stated level of confidence. (See also 'accuracy'.)
Note: The level of confidence is the fraction of the distribution of values likely to be obtained from measurement of the quantity that is encompassed by the interval.

uncertainty of measurement (UoM) An estimate of the variability inherent in a measurement based on instrument and equipment calibrations, purity of chemicals used for making calibration standards, and human factors. (See also 'calibration standard').

unit discharge Discharge per unit channel width, typically measured at a sampling vertical where it equals the product of water depth and depth-averaged velocity of flow in the vertical

unit suspended sediment load Suspended sediment load per unit channel width, typically measured at a sampling vertical where it equals the product of unit discharge and depth-integrated, velocity-weighted suspended sediment concentration.

unsampled zone The small, near-bed area of water that cannot be sampled by a depth-integrating sampler because of the vertical offset between the base of the sampler and the sampling nozzle.

unstable channel A waterway contained between banks and bed that change over time; that is, the shape of bends and banks alter and/or the bed is affected by scour and/or deposition of sediments.

USGS OSW The Office of Surface Water of the United States Geological Survey.

UV (ultra-violet) light Electromagnetic radiation with a wavelength shorter than that of visible light, but longer than X-rays; that is, in the range between 400 nm and 10 nm.

validated data Used in the NEMS *Erodible Land and Mitigation* to describe local data that has been checked and confirmed by a SCP who was independent of the original data collection or mapping. (See also 'SCP'.)

validation (of an instrument or procedure) A check to determine if a device is performing to specification, an instrument is performing to calibration, or a defined procedure is being followed. If validation of a device or instrument fails or cannot be performed, calibration is required. (See also 'verification' and 'calibration'.)

Note: Validation of a device may be similar to calibration except for lack of traceability and/or controlled conditions, e.g. using a field calibration device to check a tipping bucket rain gauge, or a Druck hand-held pressure calibrator to check a pressure transducer, or pre-deployment bench-testing of a FlowTracker ADV. When water quality sampling, validation includes measuring the given variable in a standard solution using a calibrated instrument to ensure there is no drift in calibration.

validation (of a relation or model) The process of establishing the credibility of a calibrated relation or model by assessing its ability to replicate actual process results. Some calibration data are usually set aside from calibration for this purpose. (See also 'calibration').

variable A property, parameter, determinant or analyte to be measured in situ or from a sample (e.g. flow, water level, water temperature, chloride concentration).

vector A data structure used to represent geographic features as points, lines, or polygons.

velocimeter An instrument used to measure velocity of a fluid, either submerged or non-contact. Most employ Doppler shift, either of radar, laser or acoustic signals. Other techniques process images to measure particle movement.

velocity The speed at which water flows in a given direction; specifically the rate of displacement of a fluid particle from one point to another.

velocity-area discharge measurement The most widely used method for determining stream discharge which is based on measuring the cross-sectional area of flow and the average water velocity through that area.

verification Routine inspection and testing of the measurement system to determine and document whether it is operating normally, meeting expected accuracy and performing as required. (See also 'validation' and 'calibration'.)
Note: The measurement system includes the instrumentation, the on-site installation, the means of data collection and the data collected. Testing usually involves comparisons between independent at-site measurements obtained using some form of reference gauge and the corresponding values logged from the sensor. If results of those comparisons are outside tolerance, validation of components of the measurement system, e.g. the sensor, may be necessary to identify the cause of the anomaly. Examples of verification processes are a field site inspection and data processing.

verified data Data that have been processed to the required standard, and peer reviewed.

vertical The water column at a location on a cross-section in which depth and velocity are measured when gauging~~,~~ in order to determine discharge, or from which a sample may be taken.

volumetric water content The volume of water per bulk volume of soil.

wash load The finer fractions of the suspended load (typically silt and clay grades) that are found only in trace proportions in the stream bed material. (See also 'suspended load').

water level The elevation of the free surface of a water body without reference to a known fixed datum; for example, water level read from a staff, i.e. gauge height, is not stage unless it can be directly related to the known site datum. (See also 'stage' and 'gauge height'.)

water meter (flow meter) All the components of the measurement configuration that measures and records the volumetric flow rate of water that passes through a conduit.

water year A period during the term of the water resource consent:

- starting on 1 July or, for the consent's first water year, starting on the first day on which the Regulations apply to the consent; and
- ending on the next 30 June or, for the consent's last water year, ending on the last day on which these regulations apply to the consent.

wet lab certificate A certificate of conformance from an accredited laboratory undertaking a volumetric analysis of the flow meter against a traceably calibrated reference.

wetted length The length of line immersed in the water when sounding depths and/or carrying out a gauging using cable-suspended equipment.

wetted perimeter The total length of stream banks and bed in contact with the water that forms the non-free surface boundary of a cross-section.

WGS84 (World Geodetic System 1984) The datum used by the Global Positioning System (GPS), defined and maintained by the United States National Geospatial-Intelligence Agency (NGA). For most practical purposes it is coincident with the New Zealand Geodetic Datum 2000 (NZGD2000), which is the official geodetic datum for New Zealand (www.linz.govt.nz).

WMO (World Meteorological Organization) The global body that advises on the state and behaviour of Earth's climate and atmosphere.
Note: The WMO promotes international cooperation and knowledge sharing. Their published information includes standards and best-practice guidance for observation systems and networks, technical advice, and resources for learning.

working file An electronic file containing a copy of a period of data collected from a site. Data in the working file is then processed, i.e. compared and possibly edited and/or adjusted to reference data, prior to archiving.

WS16 A standard form developed by the Water and Soil Division of the Department of Scientific and Industrial Research (DSIR) used to record station history metadata. Earlier versions of this form were known as SCC16's or Form 16's.

Symbols

α	Coriolis coefficient, a factor in velocity head formula, estimated from conveyance and area
A	cross-section area
A(λ)	absorbance, a measure of the capacity of an analyte to absorb light of the given wavelength λ nm e.g. A(440)
$\bar{A}$	mean cross-section area
A_1	upstream cross-section area
A_2	downstream cross-section area
A_c	contracted cross-section area
A_{mb}	area of section with moving bed
A_p	area of intake pipe
A_w	area of stilling well
b	cross-section width
b_n	cross-section width from initial point to vertical *n*
c	a concentration (may be suffixed for parts of a whole, e.g. c_i for concentration in a vertical, c_{os} for sand organic concentration)
c(λ)	light beam attenuation coefficient, the sum of the light absorption and scattering coefficients, as a function of wavelength λ nm, e.g. c(550)
C	Chezy's channel roughness coefficient
C	conversion factor for converting ppm to mg/l
C_D	discharge coefficient (Matthai (1967))
C_d	coefficient of discharge to correct for head loss and contraction
CF_T	**(Tracer Calibration Factor)** The coefficient used to convert **tracer electrical conductivity (EC_T)** into tracer concentration during a salt dilution discharge measurement.
C_s	equilibrium (saturation) dissolved oxygen concentration
Δ	a difference
d	water depth (sounded), depth of water column
ø	diameter
d_n	water depth at vertical *n* (sounded)
D	depth (in general terms)
D_p	diameter of intake pipe
e	effective gauge height of zero flow, stage height at zero flow, an offset
EC_{BG}	**(Background Electrical Conductivity)** The electrical conductivity of the stream water measured before the arrival of the injected salt tracer.

EC_T	**(Tracer Electrical Conductivity)** The component of measured electrical conductivity that is attributable solely to the injected salt tracer during a dilution gauging measurement.
E_d	down-welling light
E_o	scalar irradiance
F_r	Froude number
g	gravitational constant, acceleration due to gravity = 9.81 m/s^2
G_f	gauging frequency
h_{alt}	altitude
h	stage, stage height, gauge height (of the water surface)
$\overline{h}$	mean gauge height
$h\text{-}e$	effective stage
H	head of water, measured head (in general terms)
H_e	effective head
H_u	upstream measured (gauge) head
H_v	velocity head
ΔH	head loss, change in elevation of water surface between upstream and downstream cross-sections
ΔH_v	change in velocity head between upstream and downstream cross-section
K	conveyance
k	a constant, or factor
k_h	correction applied to compensate for effects of viscosity and surface tension
K_d	irradiance attenuation coefficient (down-welling)
K_o	irradiance attenuation coefficient (scalar)
L	length of reach
L	suspended sediment load (may be suffixed for parts of a whole, e.g. L_j for incremental load)
L_p	intake pipe length
L_{si}	suspended sediment load increment obtained from flow-proportional composite sampling
m	exponent in the general discharge equation
M	sample mass (may be suffixed for parts of a whole, e.g. M_i for sample mass in a vertical, M_m for mud sample)
n	Manning's channel roughness coefficient
N	sample size
ρ_s	density of sediment (typically assumed = 2.65 g/cm^3)
ρ_w	density of water (typically assumed = 1.00 g/cm^3)
p	a probability
P	wetted perimeter
P_{atm}	barometric pressure, atmospheric pressure

$\mathbf{P_w}$ pressure head (of water)

$\boldsymbol{\pi}$ pi, a constant, being the ratio of circumference to diameter of a circle

$\mathbf{Q}$ discharge, total discharge

$\mathbf{Q_{corrected}}$ discharge adjusted for moving bed (ADCP method)

$\mathbf{Q_g}$ gauged discharge

$\mathbf{Q_i}$ discharge of cross-section segment (sub-section) represented by vertical *i* (mid-section method)

$\mathbf{Q_j}$ mid-range value of j^{th} discharge band, e.g. from a flow duration table

$\mathbf{Q_{measured}}$ discharge as measured (ADCP method)

$\mathbf{Q_n}$ discharge of cross-section segment (sub-section) bounded by verticals *n* and *n+1* (mean-section method)

$\mathbf{Q_o}$ discharge as a constant

$\mathbf{Q_p}$ event peak discharge

$\mathbf{Q_r}$ rated flow; that is, flow predicted from a stage series by application of a rating curve

$\mathbf{Q_s}$ time-averaged load of suspended sediment

$\mathbf{Q_{se}}$ event sediment load (suffixed 'i' for instances in a series, or 'j' for occurrence within a discharge band)

$\mathbf{q_n}$ an instance of discharge at time interval *n*

$\mathbf{r}$ radius

$\mathbf{r^2}$ regression coefficient

$\mathbf{r_m}$ mean time between detectable rating changes

$\mathbf{R}$ hydraulic radius (= A/P)

$\mathbf{S}$ salinity, or water surface slope (as indicated by context and units of measure)

$\mathbf{S_e}$ standard error of the estimate

$\mathbf{S_f}$ friction slope (approximates water surface slope in uniform reaches under uniform flow)

$\mathbf{S_o}$ water surface slope (corresponding to steady state discharge)

SSC suspended sediment concentration (may be suffixed for parts of a whole, e.g. SSC_j for synchronous concentration in flow duration discharge band)

$\mathbf{SSC_i}$ suspended sediment concentration at vertical *i*

$\mathbf{SSC_{index}}$ index suspended sediment concentration

$\mathbf{SSC_n}$ an instance of suspended sediment concentration at time interval *n*

$\mathbf{SSC_{Qm}}$ cross-section mean suspended sediment concentration (may be suffixed for parts of a whole, e.g. SSC_{Qmn} for an instance of cross-section mean suspended sediment concentration at time interval *n* in a time series)

$\mathbf{t}$ time, elapsed time, transit time (may be suffixed for a start or end time, e.g. t_s)

$\mathbf{t_c}$ Student's 't' correction

$\mathbf{t_n}$ duration of time in interval *n*

$\mathbf{t_R}$ transit rate

$\mathbf{T}$	temperature
$\mathbf{T_r}$	transmission (of light)
$\mathbf{\theta}$	angle, notch angle (in degrees)
$\mathbf{U}$	uncertainty
$\mathbf{v}$	velocity
$\mathbf{v_{0.2}}$	point velocity at 20% of water depth from surface; etc. for other percentiles
$\mathbf{v_{bed}}$	velocity near stream bed
$\mathbf{v_{boat}}$	velocity of moving ADCP boat
$\mathbf{v_c}$	velocity at critical flow
$\mathbf{v_{mb}}$	average moving bed velocity
$\mathbf{v_n}$	mean velocity at vertical *n*
$\mathbf{v_{surface}}$	velocity near water surface
$\mathbf{v_w}$	mean water velocity (ADCP methods)
$\overline{\mathbf{v}}$	mean velocity
$\overline{\mathbf{v}}_\mathbf{1}$	mean velocity in the upstream cross-section
$\mathbf{V}$	volume (may be suffixed for parts of a whole, e.g. V_j for incremental volume)
$\mathbf{V_t}$	sample trigger volume (target volume)
$\mathbf{V_{ta}}$	accumulated water volume (actual trigger volume)
$\mathbf{V_w}$	volume of wash water added to a sample
$\mathbf{W}$	width (in general terms)
$\mathbf{x_m}$	minimum detectable value of x
$\mathbf{x_s}$	characteristic size of x
$\mathbf{y}$	mean depth, or distance
$\mathbf{y_{bd}}$	black disk visual range
$\mathbf{y_c}$	critical depth
$\mathbf{z}$	depth in the water column (below the water surface), or stage change
$\mathbf{z_{eu}}$	euphotic depth
$\mathbf{Z}$	vertical height or elevation (in general terms)

Unit Abbreviations

° degrees of a plane angle (0 to 360)

°C degrees Celsius

% percent (parts per hundred)

% Sat percent saturation

‰ parts per thousand (or **ppt**) (1000 ppm = 1 ppt)

Bq/L becquerels per litre or Bq L^{-1}
Note: 1 Bq corresponds to one disintegration per second

cfu/100 mL colony forming units per 100 mL

cm centimetre (100 cm = 1 m)

cm^2 square centimetres (10000 cm^2 = 1 m^2)

deg degrees of a plane angle (0 to 360)

FAU Formazin Attenuation Units

FBU Formazin Backscatter Units

fmol/kg femtomoles per kilogram or fmol kg^{-1} (1 fmol = 10^{-15} mol)

FNU Formazin Nephelometric Units

g gram

g/cm^3 grams per cubic centimetre (1 g/cm^3 = 1 $tonne/m^3$)

g/m^3 grams per cubic metre or g m^{-3} (1 g/m^3 = 1 mg/l)

ha hectare (10000 m^2)

hPa hectopascal

hrs hours

Hz hertz

K Kelvin
Note: There is no 'degree' symbol when using Kelvin.

kg kilogram

kHz kilohertz

km^2 square kilometres

kN kilonewtons

kPa kilopascals

l or **L** litres (1000 l = 1 m^3)

l/s or **L/s** litres per second or l s^{-1} (1000 l/s = 1 m^3/s)

l/min or **L/min** litres per minute or l min^{-1}

lbs pounds (mass)

ln natural logarithm to base *e*

m metre

m^{-1} inverse metre (reciprocal metre)

m/s metres per second or m s^{-1}

m/s^2 metres per second squared or m s^{-2}

m^2 square metres

m^3 cubic metres

m^3/h cubic metres per hour or m^3 h^{-1}

m^3/s cubic metres per second (cumecs) or m^3 s^{-1}

mA milliamps

masl metres above sea level

mbar millibar

meq/L milli-equivalent (ratio) per litre or meq L^{-1}

mg/l or **mg/L** milligrams per litre or mg l^{-1} (1 mg/l = 1 g/m^3)

mH_2O metres head of water

min minute(s)

ml or **mL** millilitre (1000 ml = 1 l; 1000 000 ml = 1 m^3)

ML/d megalitres per day (1 ML = 1000 m^3; 1 ML = 1000 000 l)

ml/s or **mL/s** millilitres per second (1000 ml/s = 1 l/s)

mm millimetres (10 mm = 1 cm; 1000 mm = 1 m)

mm/hr millimetres per hour or mm h^{-1}

mm/s millimetres per second or mm s^{-1}

MPN/100 mL Most probable number per 100 mL

mS/m milliSiemens per metre or mS m^{-1} (1 mS/m = 0.01 mS/cm = 10 µS/cm)

mV millivolts

nm nanometre (1000 000 nm = 1 mm; 1000 000 000 nm = 1 m)

NTU Nephelometric Turbidity Units

pmol/kg picomoles per kilogram or pmol kg^{-1} (1 pmol = 10^{-12} mol)

ppm parts per million (1 ppm = 0.0001%; 1% = 10,000 ppm)

ppt parts per thousand (or **‰**) (1000 ppm = 1 ppt)

psi pounds (force) per square inch (1 psi = 6.894757 kPa)

pt pint (1 imperial pint = 568.26125 mL; 1 US wet pint (for liquid volume) = 473.176473 mL; 1 US dry pint (for non-liquid volume) = 550.6104713575 mL)
Note: The imperial pint has mostly been replaced by metric units but is sometimes still used in the UK and Canada. The US pint remains in common use in the US and may also be encountered in Canada.

qt quart (1 quart = 2 pints; 1 quart = ¼ gallon, hence the name)
Note: The same variations and usage apply as for "pint".

RTU relative fluorescence unit (0 to 100%)

s second(s)

t tonne (1t = 1000kg)

TU tritium unit

µS/cm microSiemens per centimetre or µS cm^{-1} (1 µS/cm = 0.1 mS/m)

µS/m microSiemens per metre or µS m^{-1}

yr year

Annex A – Bibliography

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The following web resources have been consulted to help construct the definitions:

- Campbell Scientific's web glossary
- Wikipedia and associated services
- online dictionaries, and

- various online public information, tutorial and education resources published by recognised institutions, affiliations, and societies available in government (NZ, US, and Aus), and .edu and .org domains.


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