



WATER LEVEL MONITORING

AUTOMATED LEVEL LOGGER

Hydrometric stations typically incorporate automated water level measurements (level logger) combined with a staff gauge (see related summary). Level loggers record data continuously at a regular time interval and, thus, capture short-term and seasonal variability. They can be more cost effective than manual visits for recording water levels, and can be connected to telemetry systems for real-time monitoring. A stage-discharge rating curve can be developed between water level data and manual stream discharge measurements (see related summaries), which is then used for converting continuous water level data from the level logger into continuous discharge data.

SUMMARY OF METHOD

There are seven main steps involved with monitoring using a level logger:

1. **Calibration:** Place the logger port (near bottom of logger) at two known water depths and compare the digital readings to the actual depths. Ensure the battery and memory are sufficient for the deployment period.
2. **Site selection:** For monitoring discharge, select a site with stable channel geometry where a staff gauge and level logger (encased in a protective housing called a stilling well, which damps water level fluctuations; e.g., steel or PVC pipe) can be installed in the same wetted stream cross-section and upstream from a stable control (e.g., boulder step or waterfall).
3. **Installation:** Perforate the bottom and top of the stilling well, and mount it securely in a stable location where it will remain shielded from sediment, debris, and direct impacts. Install the logger in the stilling well below the lowest expected water level. Ensure it cannot shift during high flow, and can be returned to the same fixed position whenever removed and re-installed.
4. **Referencing:** Establish benchmarks in stable locations near the stream (see related summary). Survey logger position within the well and the stilling well elevation.
5. **Recording:** Program the logger to take readings at a regular time interval (e.g., 10 minutes, hourly).
6. **Data retrieval and maintenance:** Periodically download the logger data. Inspect the logger and stilling well for damage. Remove sediment accumulation from inside the stilling well.
7. **Data processing:** Inspect the data for errors and gaps. Develop a statistical relationship between the manual (staff gauge) and automated recordings, and apply to the automated data for referencing to the established datum.

Photo credit: WaterSmith Research Inc.

IMPORTANT CONSIDERATIONS

It is not necessary to install the stilling well vertically; long-term stability of the installation is more important. Wherever possible, secure the well to a large boulder, bedrock, or bridge abutment (e.g., using wedge anchors and metal strapping). It can be pounded deep into the streambed, but is often more vulnerable to debris movement and winter ice build-up (ice jacking).

It is desirable for the logger to be accessible in the stilling well for maintenance during all water levels, but at least during low flow conditions. Periodic re-surveying is important to confirm no vertical movement in the monitoring hardware, for ensuring accurate readings.

Drifts and step changes can occur with level logger data. Frequent manual staff gauge readings are important for identifying and correcting errors.

Both vented (barometrically corrected) and non-vented loggers are available (see related summary). Level loggers typically also record temperature, and some models also record electrical conductivity.

STREAM CHARACTERISTICS

- Upper limit on water depth is product-specific
- High sediment loads can cause deposition around logger, requiring frequent maintenance
- Most loggers require protection during freezing to avoid damaging internal components

MEASUREMENT CHARACTERISTICS

- Automated data acquisition
- Data frequency set during logger programming
- Point measurement along stream network
- Accuracy and data storage are product-specific
- Can be connected to telemetry system for real-time monitoring

SITE ACCESSIBILITY FACTORS

- Suitable for remote foot access
- Can avoid entering stream after installation
- Initial set up involves medium-sized equipment (e.g., metal or PVC pipe, rock drill)
- Ongoing monitoring involves small equipment (e.g., downloading console, hammer, wrench)

SCALE OF EFFORT: INITIAL SET UP

Equipment cost: low

Field time: moderate; ~1 day

Field expertise: moderate; logger programming, knowledge of channel morphology and flow dynamics, construction skills, elevation survey

SCALE OF EFFORT: ONGOING MONITORING

Equipment cost: negligible

Field time: very low; <15 minutes

Field expertise: low; requires basic training (moderate for elevation re-surveying)

Analysis time: low or moderate; varies with amount and quality of data

Analysis expertise: moderate; requires basic statistics and data QA/QC

PRODUCTS TO CONSIDER

See summary for vented and non-vented loggers

ADDITIONAL RESOURCES

Community Flow Monitoring Network, 2023

Resources Information Standards Committee, 2018

Water Survey of Canada, 2022a,b

World Meteorological Organization, 2010