



WATER LEVEL MONITORING

STAFF GAUGE



Water level (stage)

monitoring in streams is the process of regularly measuring the height of the water surface compared to a fixed reference point (datum). It is helpful for monitoring floods and drought, managing water resources, protecting ecosystems, and supporting discharge estimation. Typically, a staff gauge (i.e., marked ruler placed in the stream) is used for establishing the datum and for manual water level measurement. Staff gauges are inexpensive, simple, low maintenance, and do not require a power supply.

SUMMARY OF METHOD

There are five main steps involved with monitoring using a staff gauge:

1. **Site selection:** Selecting a good stream reach is critical for obtaining reliable data. The ideal location is on a straight section of stream having a stable bed and banks; deep, uniform flow lacking major obstructions or excessive turbulence; a firm, well-protected bank or structure (e.g., concrete wall, rock outcrop); and clear visibility from the bank.
2. **Installation:** Securely mount the staff gauge in a stable location where it will remain visible and shielded from sediment, debris, and direct impacts.
3. **Referencing:** Establish benchmarks in stable locations near the stream (see related summary). Survey elevation of gauge and benchmarks.
4. **Observation:** Visually observe the height of the water surface against the graduated scale on the staff gauge. Observations are made at regular intervals (e.g., monthly, weekly), or during specific events (e.g., floods).
5. **Recording:** Observed water levels are recorded manually in a record book (or digital record), along with the date and time, and the name of the attendant. Consider photographing the level on the staff gauge for record. Consider using a trail camera to monitor stage between field visits (see related summary).

IMPORTANT CONSIDERATIONS

Water level measurements are often combined with manual discharge measurements for developing stage-discharge rating curves, which are then used for estimating discharge from water level.

If a suitable straight reach is not available, it is often preferable to install the staff gauge on the inside of a bend, to minimize impacts from mobile debris.

It is preferable to install the staff gauge vertically; however, long-term stability of the installation is often more important. If needed, the gauge can be tilted (backward or forward) and the readings geometrically corrected to a vertical plane.

It is preferable to fasten the gauge to a robust backing (e.g., lumber; non-corrosive metal plate, T-bar, or L-section). The backing can be rock-bolted to a large boulder, bedrock, or bridge abutment, or pounded deep into the streambed (consider bracing to a boulder or tree).

Periodic re-surveying is important to confirm no vertical movement in the gauge, for ensuring accurate readings. Winter ice build-up can cause horizontal and/or vertical movement in the staff gauge. After ice-melt, the gauge positioning should be corrected and re-surveyed.

STREAM CHARACTERISTICS

- Safe access for installation may be impeded by a muddy streambed
- May be problematic for streams with frequent channel changes (unstable bed or banks)
- May require periodic cleaning of vegetation build-up around staff gauge and/or along channel cross-section
- Ice may need clearing from the entire channel cross-section to obtain a meaningful reading

MEASUREMENT CHARACTERISTICS

- Manual data acquisition
- Frequency of readings determined by site visits
- Point measurement along stream network
- Accuracy varies with water surface roughness

SITE ACCESSIBILITY FACTORS

- Suitable for remote foot access
- Can avoid entering stream after installation
- Initial set up involves medium-sized equipment (e.g., metal backing, staff gauge, rock drill, hammer, wrench, survey level, stadia rod)
- Ongoing monitoring involves small equipment (e.g., record book, phone camera)

SCALE OF EFFORT: INITIAL SET UP

Equipment cost: very low

Field time: moderate; ~1 day

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

SCALE OF EFFORT: ONGOING MONITORING

Equipment cost: negligible

Field time: very low; <15 min

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

Analysis time: negligible

Analysis expertise: negligible

PRODUCTS TO CONSIDER

Staff gauge: Water Survey of Canada Staff Gauge

ADDITIONAL RESOURCES

Community Flow Monitoring Network, 2023

Resources Information Standards Committee, 2018

Stamp et al., 2014

Water Survey of Canada, 2022a,b

World Meteorological Organization, 2010