NETLAKE Guidelines for automated monitoring system development

004 How to moor a long term station

Objective

In this factsheet, we describe three examples of how to moor an automatic monitoring station

Considerations

The mooring design depends on:

- Depth of water
- Likely wind speeds and direction
- Longevity of deployment (days or year?)
- The total weight of equipment
- Buoyancy of the platform
- Cost
- Ease of access (how big a boat can you use for the deployment?)

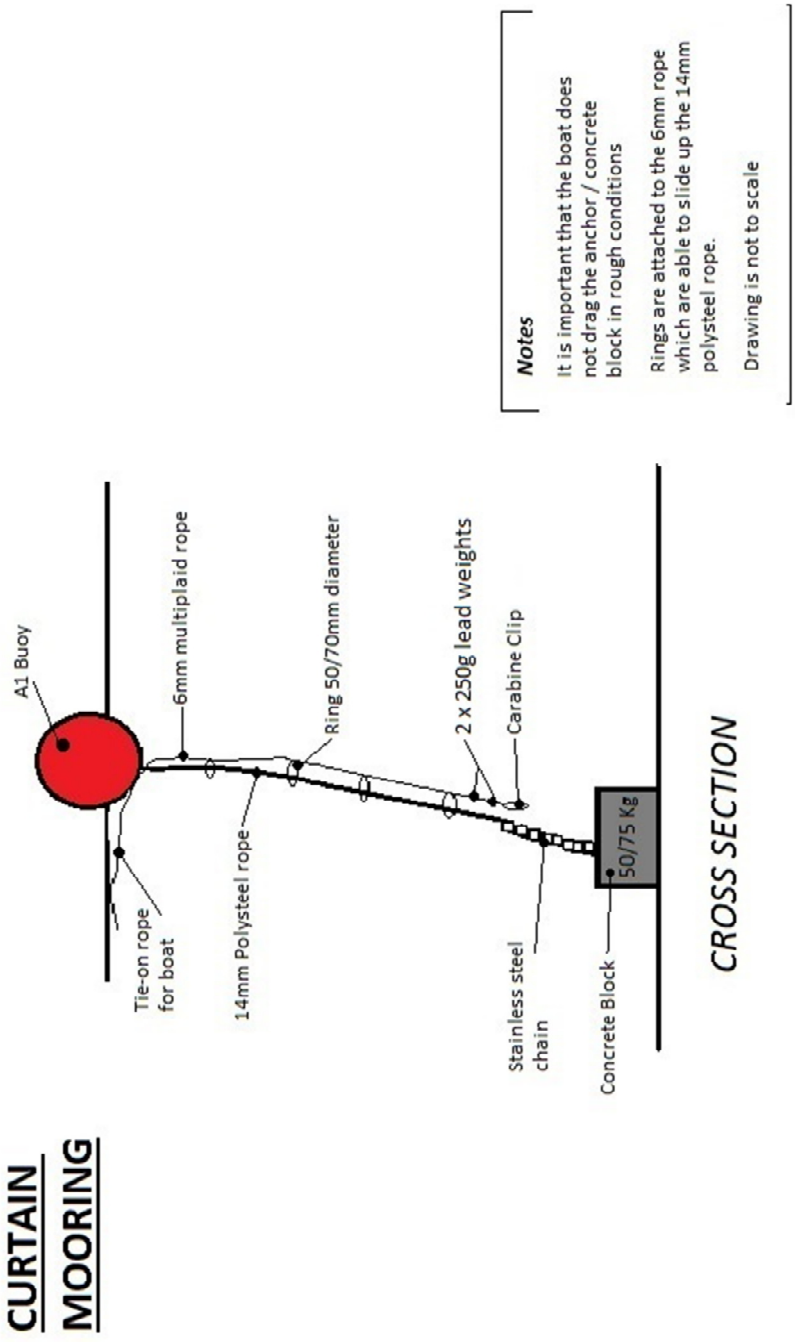
Examples

Three examples are described below, which should be adjusted according to conditions on site.

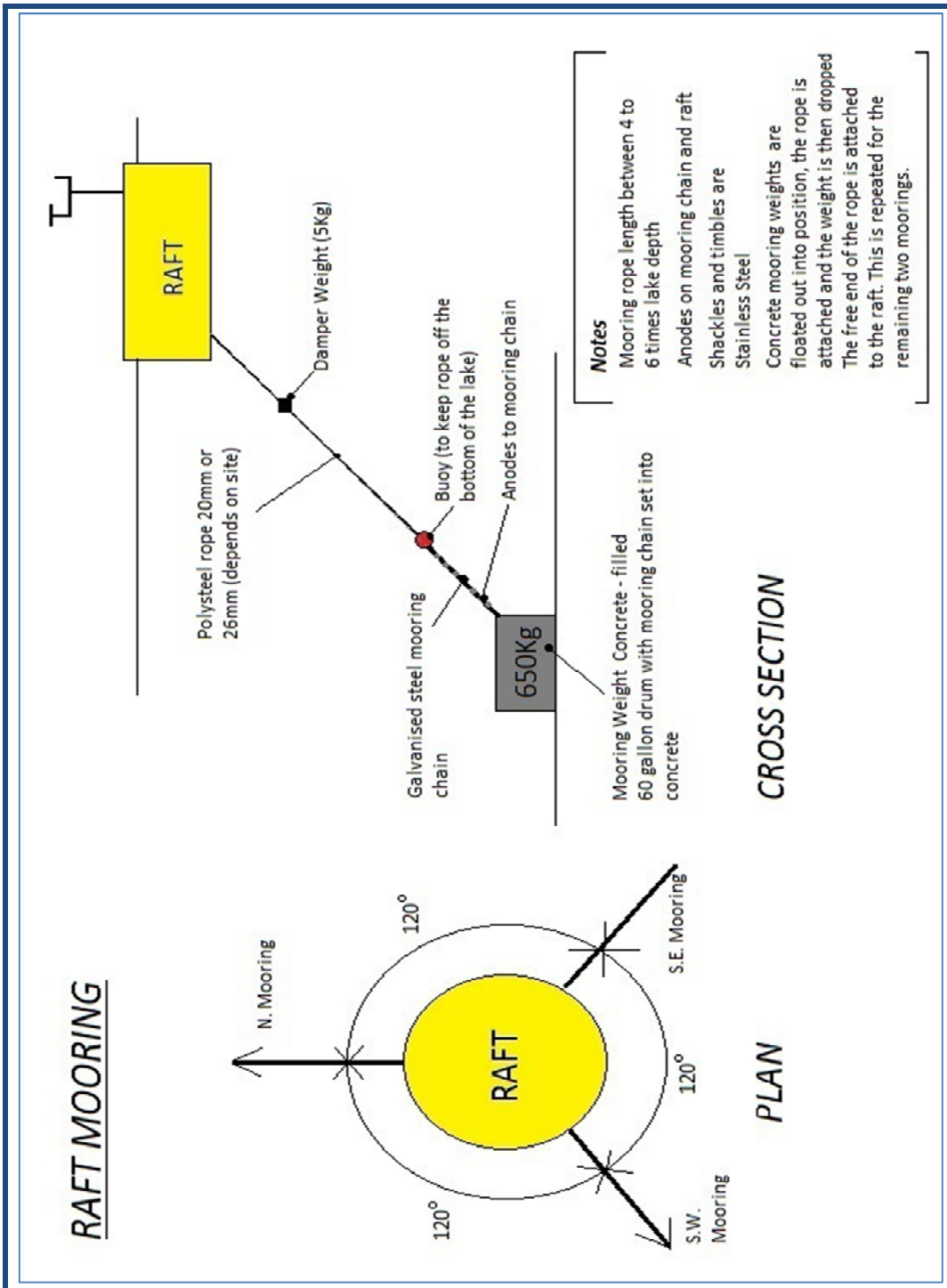
Example 1 is a low cost, single anchor mooring, suitable for deployment of small, lightweight sensors. This set up does not include room for batteries, solar panels etc. This type of mooring is ideal for a string of small temperature or dissolved oxygen sensors such as Onset temperature Tidbits or a PME miniDOT. It is a bottom tensioned line, whereby the small weight at the bottom of the sensor line ensures that the line is vertical at all times. The curtain rings allow the sensor lines to be pulled up and redeployed without tangling around the anchor line.

Example 2 is a more permanent structure for mooring a stable (i.e. not swiveling with the wind) long term platform, fit to hold batteries, sensors, loggers. This example can be seen in operation in Lough Feeagh, Co. Mayo, where a raft has been in place for 20 years. Moorings ropes have been changed periodically in that time. The essential items here are the mooring ropes which need to be several times longer than the maximum depth of water. This allows the anchor chain to lie flat on the lake bottom, and also allows enough slack rope to accommodate varying wind directions. The mooring ropes are connected to the underside of the raft using stainless steel shackles and timbles which can be replaced periodically. This is best done by splicing the mooring rope to make a loop containing a timble (Fig. 1). Sacrificial anodes around the mooring anchors (shaft anodes) can help reduce the amount of corrosion in long term deployments, especially if the waterbody is somewhat saline. Sacrificial anodes are highly active metals that are used to prevent a less active material surface from corroding. Sacrificial anodes are created from a metal alloy with a more negative electrochemical potential than the other metal it will be used to protect.

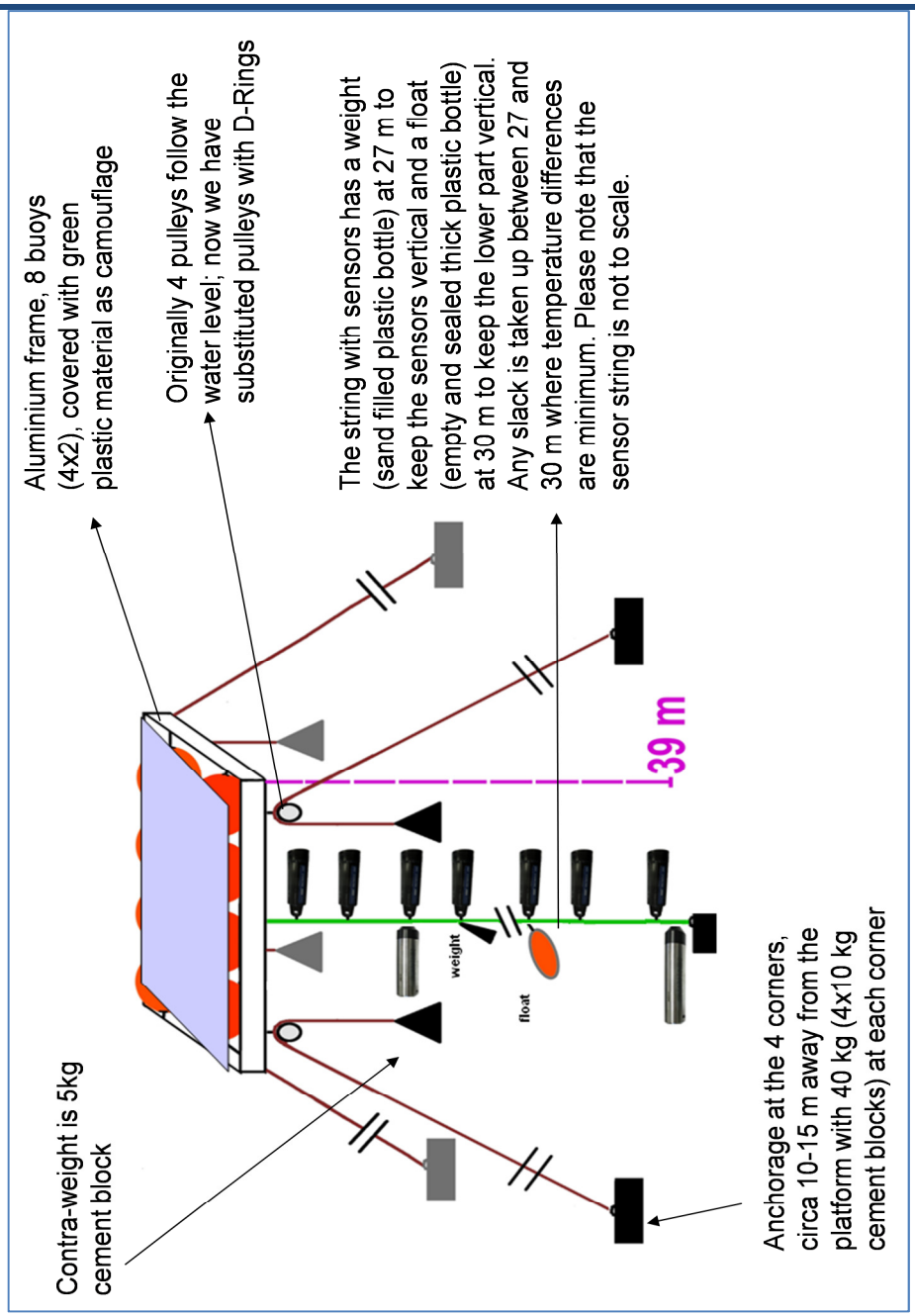
Example 3 is a permanent mooring for a station in a lake with a significant drawdown. This is in operation in Lake Tovel in Northern Italy where water fluctuations in the year are between 2 and 4 metres. However, the moorings needed to be designed for a water drawdown of up to 7m. The contra-weights on each corner ensure that the mooring lines do not become too slack, while still allowing sufficient length to enable the station to rise and fall with changing water levels.



Example 1: Picture credit: Joe Cooney (mooring design) and Brian Doyle (graphics)



Example 2: Picture credit: Joe Cooney (mooring design) and Brian Doyle (graphics)



Example 3: Picture credit: Giovanna Flaim

Likely Problems

- The mooring breaks either at the bottom, top or along the length of rope. The only way to avoid this is to visually check the moorings regularly (at least once a year, if not twice). In the case of a three point mooring, one line is likely to get worn quicker than others, according to the prevailing wind, so check the one under the most amount of pressure.
- You don't have enough slack on the line - this leads to undue pressure on the connectors, and also means that the top buoy may submerge. Plan to do an initial deployment, and a check very soon after. If necessary, lengthen the mooring lines.
- You have too much slack on the line/lines. Here, there is a risk of entanglement (around your boat, or around the sensors). Ropes can be coiled and tightened if necessary, but better to plan on shortening the lines once the deployment has settled in its location.
- The mooring weights are not heavy enough. Try and use the heaviest weight that is practical (e.g. what weight can you bring out in your boat).

More information

http://pme.com/products/lakeesp
http://www.onsetcomp.com/products/data-loggers/utbi-001
http://pme.com/products/minidot
http://burrishoole.marine.ie/Lakes/Feeagh
https://sites.google.com/a/fmach.it/lter-tovel/

See also AMSD factsheet 001, 002 and 003 for more information

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