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Monitoring Turbidity in an Ultra-Ologotrophic Drinking Water Reservoir

MONITORING TURBIDITY IN AN ULTRA-OLOGOTROPHIC DRINKING WATER RESERVOIR

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This paper describes the methodology and results of long-term continuous field monitoring of turbidity at Coquitlam Reservoir in Metro Vancouver, British Columbia, Canada. This reservoir is the largest and only remaining unfiltered source supplying high quality drinking water to several municipalities in the region. Coquitlam Reservoir is classified as ultra-oligotrophic, with extremely low nutrient loading. The turbidity throughout the reservoir is normally very low, except during fall and winter storm events when tributary inflows can occasionally become turbid due to bank erosion or landslides, leading to slightly elevated turbidity in parts of the reservoir (Pieters et al. 2011).

To meet increasing water demand, a second intake is being considered for Coquitlam Reservoir to provide increased flow, to access more storage, to withdraw colder water in summer, and to minimize turbidity in fall and winter. In order to evaluate potential sites for a second intake, instrument moorings were installed in December 2007 at two mid-basin locations. At each site Wetlabs ECO NTUSB turbidity recorders were deployed at three elevations, with depths of 9, 34 and 64 m from the average summer water level (Figure 1). These instruments provided reliable, low noise and accurate data, even at low turbidity. Along with the turbidity recorders, temperature recorders were deployed to measure stratification.

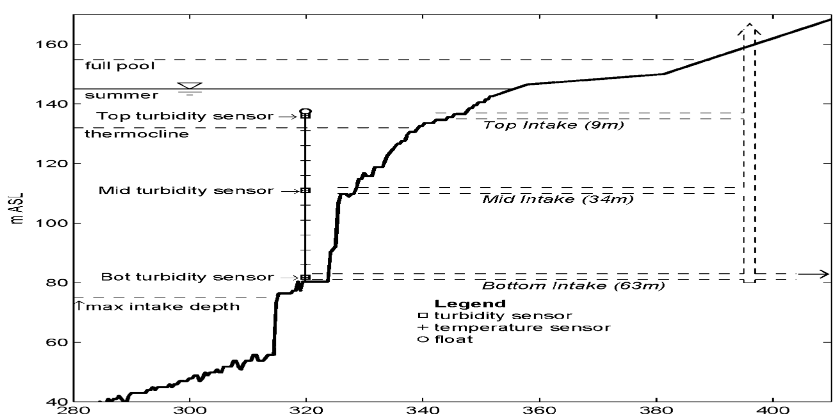

Figure 1 Schematic of subsurface mooring design next to underwater cliff faces. Sketched are potential intake tunnels to select water from three different depths

The turbidity was generally low (< 1 NTU) throughout the mooring period of just over 4 years at the two monitoring sites. The mean turbidity varied by sensor from 0.29 and 0.34 NTU. For all sensors, the turbidity was < 0.5 NTU for 90% of the time, the turbidity did not exceed 1 NTU at more than one depth at a time, and no turbidity events (> 5 NTU) were observed (Figure

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2). The turbidity data also exhibited a repeated seasonal pattern: turbidity increased slightly in the fall, when rainfall and tributary erosion are highest. Early in the fall, the turbidity is isolated by the temperature stratification; later in fall, turbidity in the surface layer is mixed down as the surface layer cools and deepens. The resulting winter turbidity ranged widely from 0.4 to 1 NTU. From January to April the turbidity declined at all depths to ~ 0.4 NTU. After April, the turbidity remained relatively constant at the top sensor while the turbidity at the mid and bottom sensors continue to trend downward through the summer to 0.2 to 0.3 NTU. The temperature at the top turbidity recorder reached a maximum of ~14 ºC in early fall, while the temperature at the mid and bottom turbidity sensors remained between 4 and 5 ºC throughout the year.

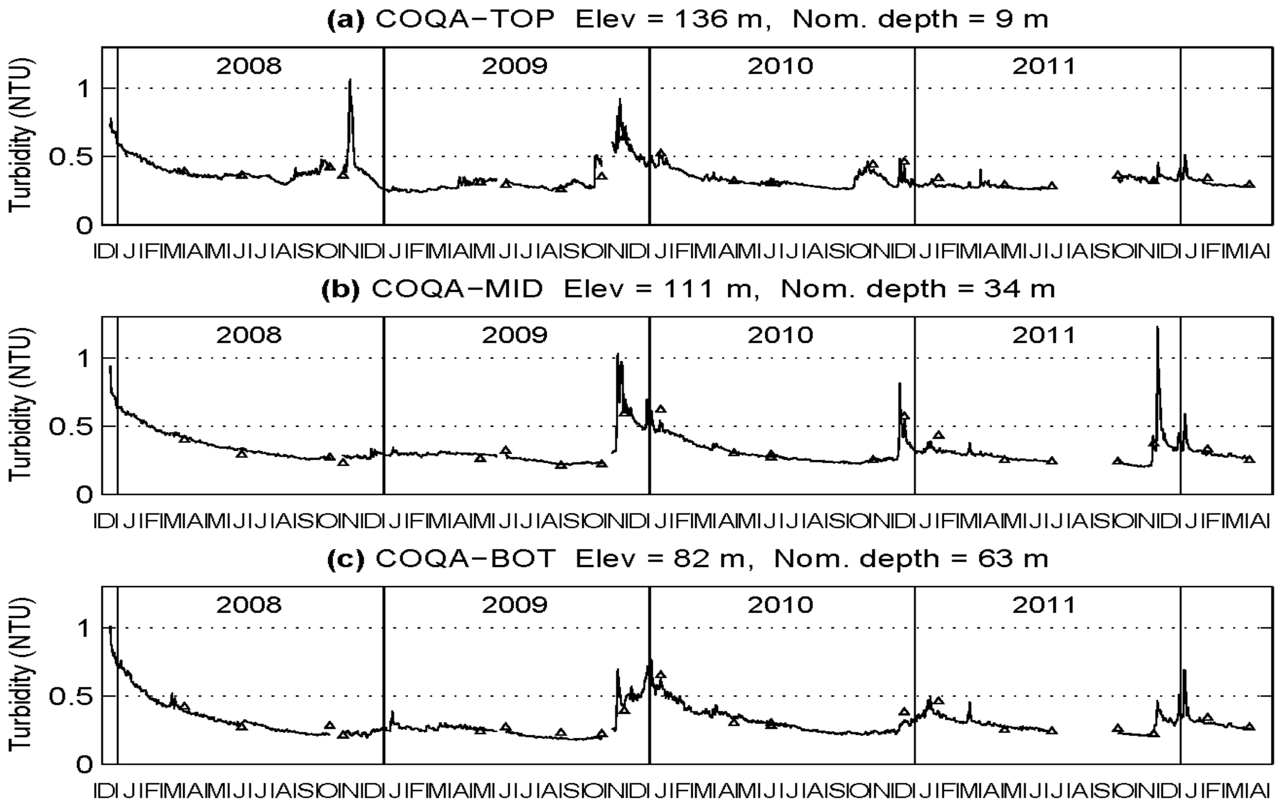

Figure 2 Daily averaged turbidity at a potential intake site (COQA) at three depths, 2007-2012. Triangles mark bottle data analyzed with a Hach 2100p turbidity meter within 12 hr. of collection.

REFERENCES

Pieters, R., Gu, L. and Lawrence, G. (2011) "Turbid Inflow into a Drinking Water Reservoir", Proceedings of the International Conference on Drinking Water Safety, Security and Sustainability, Hangzhou, China. October 2011.