In-Situ Inc.

Innovations in Water Monitoring

Technical Note

Monitoring Water Levels in Impoundment Structures

October 2014

Introduction

Monitoring water levels of impoundment structures is often required by regulations, regardless of industry. Using Level TROLL® or Aqua TROLL® Data Loggers in natural or man-made open air pits, ponds, tanks, and canals may increase the efficiency of monitoring response teams and treatment processes by providing continuous, real-time data and alarms during changing conditions.

Why Use Data Loggers?

Data loggers provide 24/7/365 on-site monitoring of impoundments. This monitoring provides a more complete data record, which may be accessed in real-time or on a schedule. Data loggers provide crucial alerts when significant water level or water quality changes occur to the impoundment. Data loggers may be connected to controllers or to additional hardware that performs operations autonomously based on level readings, such as activating pumps, initiating treatment cycles, or sending data files or notifications to operators who may be offsite. In remote locations, data loggers may be connected to wireless or satellite networks to reduce site visits.

Which Data Logger is Appropriate?

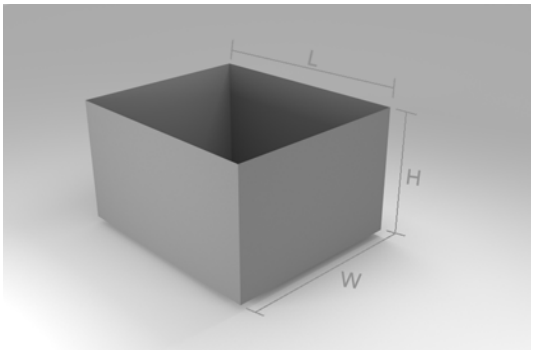
Level TROLL Data Loggers are used in impoundments where only water level/pressure and/or temperature need to be monitored. Aqua TROLL Data Loggers are used in impoundments where additional constituents need to be monitored. These can include conductivity (actual and specific), salinity, total dissolved solids (TDS), resistivity, density, dissolved oxygen, ORP, pH, or temperature, in addition to water level. The Aqua TROLL 200 can be programmed to automatically correct water level for changes in water density (dynamic density compensation). Real-time adjustments to water level readings provide the most accurate water level readings.

How Do Data Loggers Monitor Level in Impoundments?

Accurate measurement of water level in an impoundment begins with an accurate calculation of the volume of the impoundment. This volume calculation is used in conjunction with data logger measurements to determine changes in level.

Depending on the type of impoundment, volume calculations can be simple or complex equations. Man-made impoundments, whether manufactured or excavated, are typically simple due to regularity in their shapes.

- Rectangular tank/pond: Length x Width x Height
- Circular tank/pond: π (3.1415) x Radius^2 x Height



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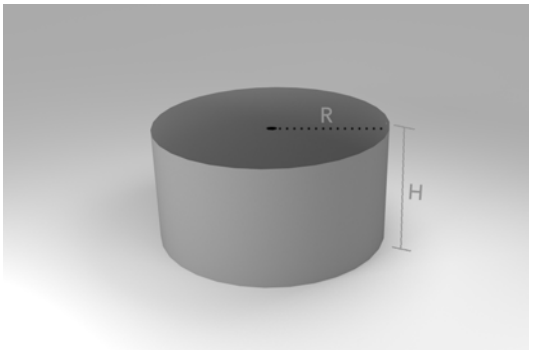
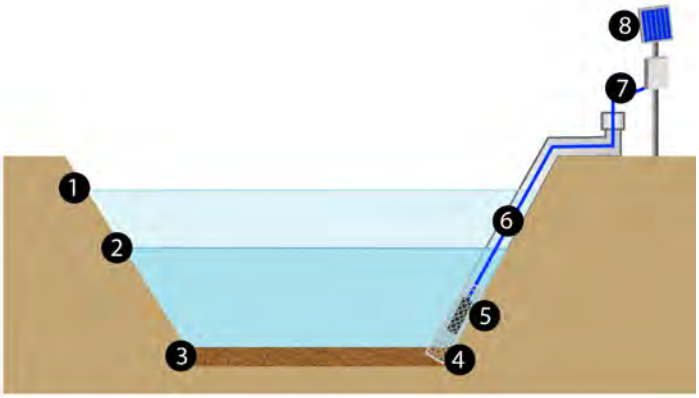
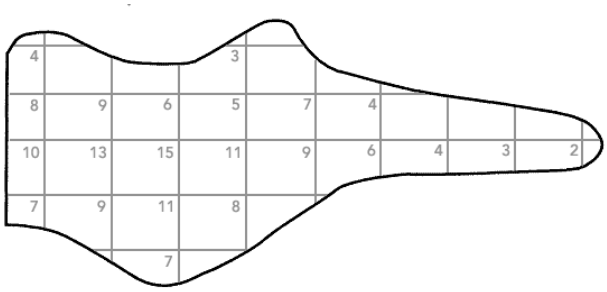




1	High water level
2	Low water level
3	Silt/mud layer
4	Aluminum/plastic screen
5	Data logger
6	Stilling well (PVC with holes on bottom)
7	Cable
8	Telemetry system/controller/local display

Natural pits, ponds, or other open-air impoundments are typically more complex due to their irregular shapes. These types of impoundments require calculation of the average depth and the surface area. Average depth is measured using a grid pattern covering the entire impoundment area. Record the depth measurements for each section of the impoundment. Add each measurement together and divide by the total number of measurements to calculate the average depth.



(4+8+10+7+9+13+9+6+15+11+7+3+5+11+8+7+9+4+6+4+3+2) ÷ 22 = 7.31 average depth

The surface area of irregularly-shaped impoundments can often be calculated by combining different shapes and adding their corresponding surface areas together. Multiplying the total surface area by the average depth provides the volume of the impoundment.

Volume of natural or irregularly-shaped impoundments may be a one-time calculation, or may need to occur more often depending on the frequency of changes to the impoundment.

Data loggers are deployed once the impoundment's volume, low water level, and high water level have been determined.