Addressing Mining Pollution Across the United Kingdom

Challenge

The Coal Authority was in need of evaluating the effectiveness of mine treatment schemes to deliver strong economic and environmental benefits to solve water pollution from abandoned coal mines.

Solution

A monitoring system based on OTT ecoLog 500 level loggers to measure groundwater depth and temperature. Data transmitted via cellular or radio transmission to an FTTP server in the cloud.

Benefits

OTT HydroMet's telemetry options help reduce staff involvement and consolidate costs. Now, staff occasionally check equipment for maintenance purposes but can overall leave sites running unattended.

"Our support from OTT HydroMet has been absolutely brilliant. They've come onsite to offer advice, show how to install equipment, and more."

Paul Robinson, Data & Support Manager - Severn Trent Services

a brand of OTT HydroMet

Background

During the 1700's when the Industrial Revolution progressed in England, coal mining became more widespread as demand for coal energy grew (NCM, 2019, p. 2).

In more recent years as the coal mining industry has declined, abandoned mines have become one of the biggest pollution threats in Britain due to mine water, which can contain heavy metals and pollutants, being discharged into public waterways through groundwater in particular (Environmental Agency, 2008, p. 5).

The Coal Authority was established in 1994 to manage the nation's coal assets and the historical liabilities from British Coal. Their role is to protect the public and safeguard the environment from historic mining issues, including polluted water from disused coal and metal mines.

The Coal Authority currently operates approximately 75 mine water treatment schemes, to prevent 4000 metric tons of iron solids from entering the UK's water courses, including drinking water aquifers, each year. This includes aquifer protection for 500,000 people with benefits valued at £30.5 million per year (The Coal Authority, 2019). These schemes are spread out across the United Kingdom, and they are built to treat the raw mine water and then discharge to the water course within stipulated consents.

Responsibilities of the Coal Authority include:

- Managing the effects of past coal mining
- Providing mining information and property search services
- Licensing coal mining operations in Britain
- Providing a 24-hour emergency service for public safety hazards

(The Coal Authority, 2019)

Beyond the concern of minerals like iron in public and natural waterways that could turn water orange, disrupting aquatic habitats and life, there are several concerns with mining that need to be understood and mitigated. The old entrances of mines, both shafts and adits, can be hazardous for the public. Underground water can also become polluted and can compromise the environment if it works its way to the surface.

Overflow Channel at Water Treatment Scheme (Severn Trent Services, 2018)

Monitoring Network

In 2015, the Coal Authority contracted Severn Trent Services to operate and maintain mine water treatment schemes, pumping stations and mine gas facilities across Scotland, the north east and north west of England, central England and South Wales. This is made up of 85 sites that contain over 850 monitoring points, and specifically consist of: 10 subsidence pumping stations, 73 mine water treatment schemes, and 2 metal mines.

By combining the expertise of Coal Authority and Severn Trent Services, both organizations aim to enhance solving water pollution from coal and metal mines to “deliver innovation and schemes with strong economic and environmental benefits,” as stated by Simon Reed, the Coal Authority’s former Chief Operating Officer (Ballard, 2018).

Data collected includes water depth, temperature, pumping rates, flow rates, energy usage and sampling, each with their own necessary frequency. Severn Trent Services collects this information and provides data reports to the Coal Authority team for analysis to assess how schemes are performing and whether water levels are rising. Conclusions are pulled from the analysis conducted to see which decisions need to be made for further improvement or changes.

Severn Trent Services enlists OTT HydroMet for over 100 instruments spread across the United Kingdom, with plans for expansion. They first found the company through online

Water Treament Scheme in Hockery Brook (2015)

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> – Paul Robinson, MI, Data & Support Manager, Severn Trent Services

research, began work in early 2016, and currently focus on OTT ecoLog 500 level loggers to measure groundwater depth and temperature.

The data allows the Coal Authority to satisfy their obligations to relevant environmental bodies by supporting their project teams when assessing and designing schemes moving forward. Insights from data also allow their Tech Team to offer advice to various external bodies and their internal design teams.

One project involving the OTT HydroMet team is the Force Crag Mine, which is a mine that was abandoned in 1991 as the last working metal mine in the Lake District. This is where the Coal Authority (in collaboration with the National Trust, Newcastle University, the Environment Agency and Defra) built one of its first treatment schemes to address pollution in water from abandoned metal mines; the site was historically used to mine lead, zinc, and barytes (Force Crag Mine, 2013).

The original monitoring system for Force Crag comprised of OTT ecoLog 500's that transmitted data through SIM cards via cellular transmissions. However, the surrounding natural landscape of valleys and the remote location of the sensors made cellular telemetry difficult, and the team reached out to OTT HydroMet to design a solution with radio transmission.

Initially, the OTT HydroMet team carried out a walkover and radio survey on the site to assess the feasibility for radio data logging and remote data transfer. The team worked with the two organizations to recommend the following full site plan for the Force Crag scheme:

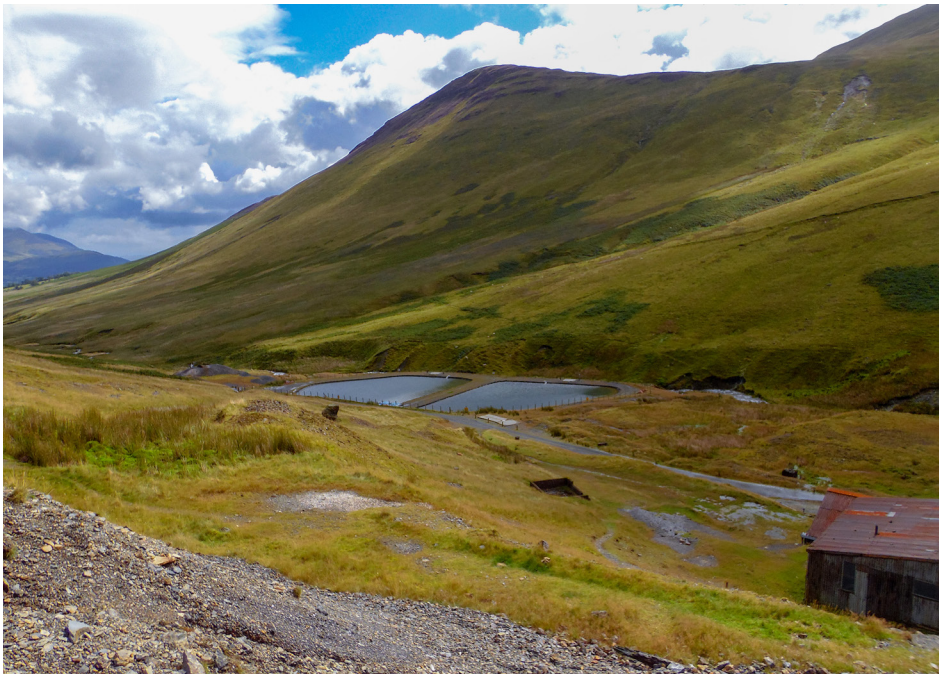
- 14 monitoring locations
- 9 locations with radio transmitters
- 5 locations with single sensor and radio transmitter
- 4 locations with 2 sensors wired to a single radio transmitting unit
- 1 location with the sensor wired directly into a GPRS transmission station
- 2 GPRS Transmission Sites

The first phase of the plan involves installing two OTT netDL 500 Data Loggers and 14 sensors to measure water depth and temperature at the site. These will transmit data to an FTP server in the cloud, which will then be processed and uploaded to an SQL database.

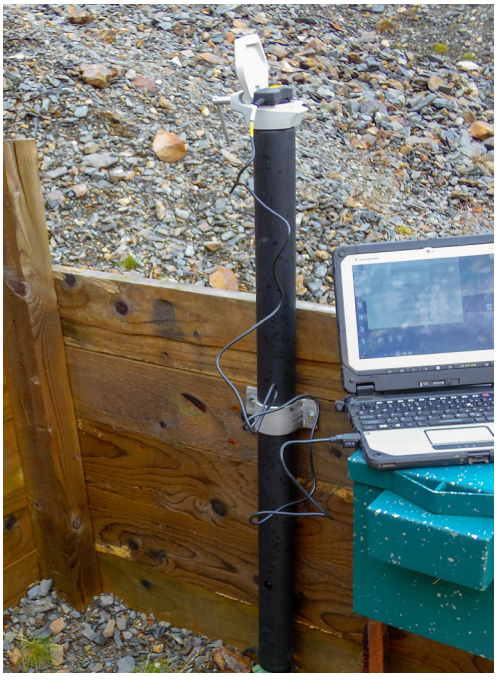
It is envisaged that the existing OTT ecoLog 500 loggers will remain in position for up to 2 weeks to ensure no loss of data while staff confirm the new system is collecting data accurately. After this, the older loggers will be removed and redistributed across the estate managed by Severn Trent Services.

Telemetry capabilities have had a big impact on data collection for the two collaborating organizations. Staff no longer need to go into the field to manually check sensors. For a government agency like the Coal Authority with a set budget, more accessible telemetry options help reduce staff involvement and consolidate costs. Now, staff only need to check equipment for maintenance purposes but on the whole, can leave sites running unattended.

More efficient and advanced monitoring networks allow organizations like the Coal Authority and Severn Trent Services to continue doing their important work to protect waterways and the environment.



Restoration in Water Treatment Scheme (Severn Trent Services, 2018)



Logger in the Field
(Severn Trent Services, 2018)

Technologies used

OTT ecoLog 500

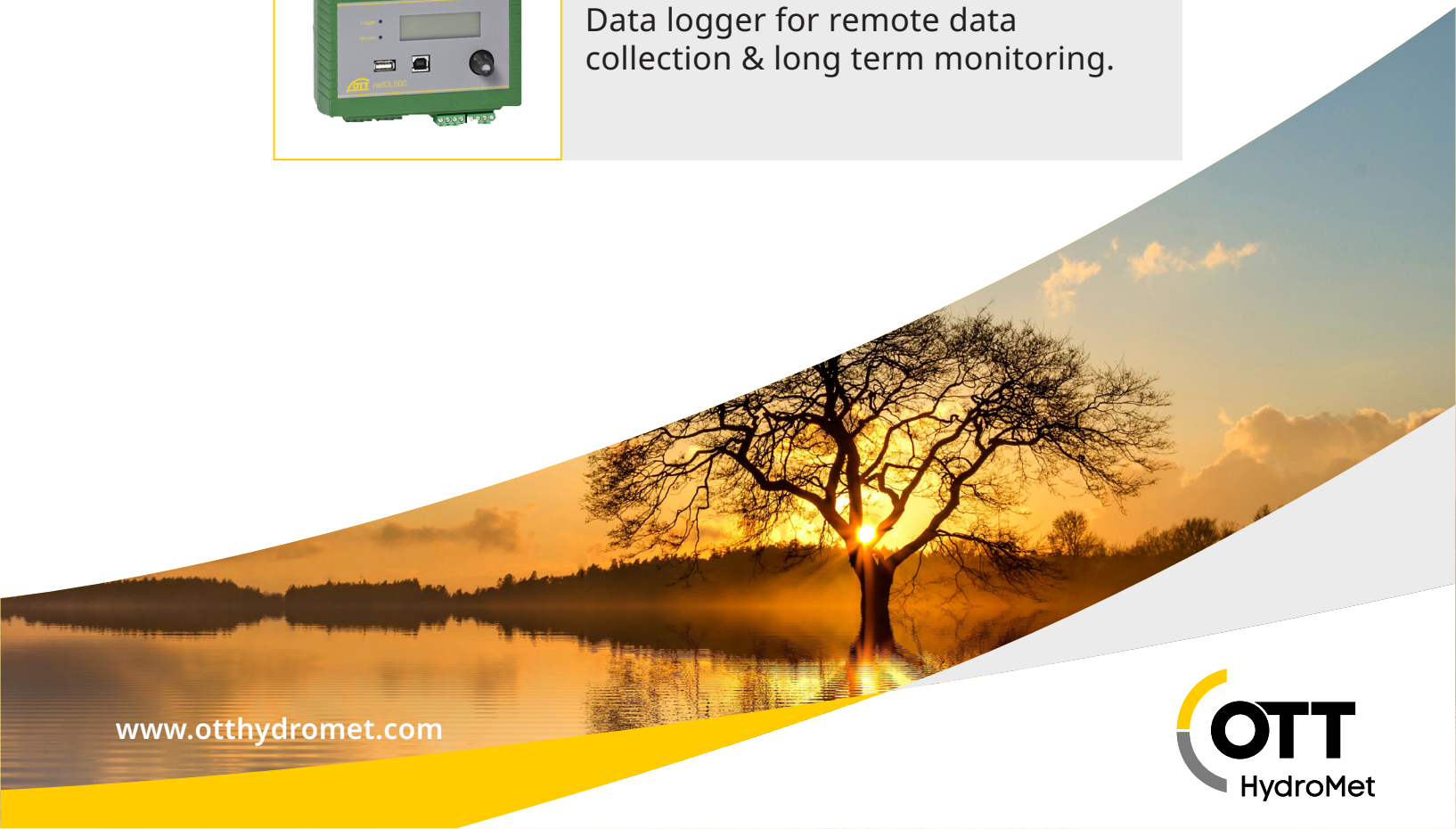
Water Level Logger

Water level sensor with built-in datalogger for surface and groundwater applications.

OTT netDL

Data Logger

Data logger for remote data collection & long term monitoring.



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