

## Mine Dewatering Application Note

### Optimizing Dewatering Processes in Mining Operations

*Level TROLL<sup>®</sup> and TROLL<sup>®</sup> Link Telemetry systems provide real-time data access and alarm capability*

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#### Application

Effective water management is critical in both open-pit and sub-surface mining operations. Mine dewatering is an essential part of resource extraction, as it lowers the water table around the mine or quarry. Effectively managed dewatering processes typically employ continuous water level monitoring. Mine dewatering is usually undertaken for several reasons:

- **Ensure stability of mine walls during and after excavation**—In open-pit mines, a water table that is too high can destabilize mine walls, haulage roads, and slopes. Water pressure reduces the stability of mine walls and can lead to sliding and collapse of materials in the slope. In underground mines, the inflow of water must be controlled to prevent flooding, however, a balance must be maintained so that ground water levels are not needlessly depleted.
- **Optimize mine production and reduce operational costs**— Effective dewatering operations create dry conditions so that low-strength aquifer sequence materials (sands, gravel, and clays) can be safely excavated, reducing drilling and blasting costs. Additionally, wear and corrosion on equipment is minimized, and the possibility of pump burn out is reduced by accurately monitoring drawdown. Haulage costs for unsaturated excavated material is significantly less than for saturated materials, further reducing operational cost.

Mine dewatering can be achieved by pumping continuously from a series of dewatering wells around the mine and by installing pumps in



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special sumps on the mine floor to remove surface water. Mine dewatering operations must optimize the locations and pumping rates of these dewatering wells, as well as control regional drawdown—this cannot be achieved without accurately monitoring ground water levels around the mine and surrounding areas. Depending on geologic conditions and mining practices, cones of depression (ground water drawdown areas) can be as small as the quarry itself or as large as 9.65 sq mi (25 sq km) (Langer, 2001).

#### Assessing the site

Long before mining operations begin, feasibility studies are conducted to assess hydrogeological conditions of a potential site. Upon completion of detailed hydrogeological assessments, plans are developed and permits are obtained for various activities including dewatering and mine water discharge.

Preliminary assessments are completed to:

- **Determine site feasibility**—This includes aquifer characterization, such as large-scale pumping tests that determine hydraulic conductivity (K) and recharge rates. These studies provide critical information for designing mine operations and for determining potential impacts to regional ground water resources.
- **Establish baseline data**—This data is used throughout all phases of a mining operation to ensure effective water management, to monitor water quality and quantity, and to regulate dewatering operations.
- **Design dewatering systems**—Engineers must understand all hydrogeological properties of a site in order to design effective and efficient dewatering systems that meet permit requirements.

## Selecting the right equipment

In-Situ<sup>®</sup> equipment is used throughout all phases of mining operations; from initial site characterization to ongoing water level monitoring during mine operation to discharge permit compliance monitoring. Data is often sent to mine engineers using telemetry systems in order to provide real-time data and potential alarm conditions.

- **Level TROLL<sup>®</sup> 700**—Characterizes the site during initial feasibility studies by measuring and logging water level, pressure, and temperature. The Level TROLL 700 offers advanced logging modes such as true logarithmic and step linear sampling—used during large scale pumping tests to accurately monitor drawdown and determine hydraulic conductivity (K). Data can easily be transferred to software packages, such as AQTESOLV<sup>™</sup>, to perform additional high-level aquifer analysis.
- **Level TROLL<sup>®</sup> 500**—Monitors daily mine operations by measuring and logging water level, pressure, and temperature. The Level TROLL 500 has standard linear and event monitoring modes and can communicate with telemetry devices, SCADA systems, or machinery via its native RS485, SDI-12, Modbus, or 4-20 mA output options.
- **Aqua TROLL<sup>®</sup> 200**—Delivers additional water quality information by measuring and logging water level, pressure, temperature, plus

conductivity. The Aqua TROLL 200 can be used to enhance daily water level monitoring programs by providing important information on any changes in the ground water matrix. In addition, tracer studies can be conducted by monitoring changes in ground water conductivities caused by injection of tracer compounds.

- **TROLL<sup>®</sup> 9500**—Monitors a variety of water quality parameters, including discharge, to ensure permit compliance. The TROLL 9500 can be deployed remotely to collect water quality data, trigger a remote sampler, or telemeter data to mine operators.
- **TROLL<sup>®</sup> Link Telemetry**—Provides critical data to mine engineers and operators in real time. The system can be set to alarm mine personnel to changing conditions via email, SMS text, or phone.

## Managing data to make decisions

Managing volumes of data from multiple well locations at a large mining site can be challenging. Mine technicians need easy access to accurate data in order to manage dewatering operations and to meet permit requirements. In-Situ's integrated Win-Situ<sup>®</sup> 5 and Win-Situ<sup>®</sup> Mobile software offer site data management, graphical interface, and real-time indicators of instrument, memory, and alarms. With a one-time set up, operators can input site and well information into their laptop or In-Situ RuggedReader<sup>®</sup> handheld PC. The Win-Situ<sup>®</sup> Sync utility allows the rapid transfer of site and well information to field teams.

## Telemetry provides instant data access and alarming

A TROLL Link Telemetry system communicates with remotely deployed monitoring equipment and allows operators to view and acquire data without site visits. Accessing equipment via telemetry allows rapid data acquisition while reducing manpower and vehicle costs. In addition, real-time communication with remote instruments can alert users to changes in the matrix that would not be observed until the next site visit.

A TROLL Link Telemetry system and Aqua TROLL 200 can be set to transmit real-time data every 60 minutes, for example, during a

“non-event” state. The integrated system can be programmed to alarm users if pre-set values are triggered. For example, if the water level in a dewatering well drops below a specified point or if conductivity exceeds a pre-determined level, the instrument’s alarm mode will be activated. The TROLL Link system automatically notifies the user about the “event” and can increase the data transmission rate to capture high-resolution event data. Alarm

messages can be sent to multiple personnel using SMS text messaging, email, or phone.

In-Situ offers several economical telemetry options based on user requirements. Both satellite and cellular systems are available, with wireless data access via Win-Situ software or In-Situ’s secure web-based Data Center.

## Recommended Systems for Mining Operations

Application	Level TROLL 500	Level TROLL 700	Aqua TROLL 200	TROLL 9500
Aquifer characterization; pumping and slug tests	O	X		
Baseline and long-term water quality studies			O	X
Operation & management; long-term monitoring	X	O	O	
Long-term precipitation and recharge monitoring	X	O	O	
Tracer and event monitoring			X	

X = recommended by In-Situ Inc.    O = can also be used

## References

1. Langer, W.H. 2001. *Potential Environmental Impacts of Quarrying Stone in Karst—A Literature Review*. USGS Open-File Report of-01-0484. <http://pubs.usgs.gov/of/2001/ofr-01-0484/ofr-01-0484so.pdf>
2. Mandzic, E.H. 1992. Mine Water Risk in Open Pit Slope Stability. *Mine Water and The Environment*. 11(4):35-42.
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