ASTERRA

The Intelligence to Act

EarthWorks Mining

Satellite-Based Prevention of Infrastructure Failures

"See" Where Soil Moisture is Putting Lives & Operations at Risk

EarthWorks shows mine operators where moisture is seeping from tailings dams and pipelines, collecting under mining roads and heavy equipment sites, and weakening surrounding hillsides - all with remote sensing techniques that cause no damage to the ground. Mining operations are highly vulnerable to the impacts of soil moisture.

Tailings dams can be subject to seepage, then internal erosion, piping, and finally collapse due to loss of support following these events. Soil moisture can cause landslides in mine hillsides and potholes in mining roads. Yet, current monitoring techniques are unable to 'see' subsurface moisture across broad areas until after deformation or movement occurs, leaving little time for remediation.

ASTERRA's patented EarthWorks technology is a new tool to provide ongoing, preventive, economically viable scale-up monitoring of mining operations. From an orbiting satellite and a highly sensitive radar band that reflects off underground moisture, regardless of the time of day, weather conditions, or surface changes, the soil moisture maps that EarthWorks provides can identify moisture from seepage and other causes, sometimes years before warning signs can be seen or detected by sensors. Having no labor, equipment, or testing fees, and using minimal scans, this cost-effective solution delivers a high return on investment. Mine operators can use EarthWorks to optimize maintenance and safety, improve design and operations, locate leaks in production pipelines, and document compliance. They can also use it to monitor soil moisture under hillsides, roadways, work sites, and leach pads. These insights complement and enhance current surveillance programs and provide engineers and inspectors with additional time to respond to unforeseen conditions and devise response plans.

EarthWorks Insights on EO Discover

With a subscription to ASTERRA's EO Discover platform, customers receive an alert for at-risk areas to prioritize their inspection resources and address critical issues as quickly as possible. Reports, dashboards, notifications, and key metrics are all available in one place. The service includes data download options in GIS data format for viewing in Esri or other common software.

"Without major changes to law, regulation, and to industry practices, as well as without new technology that substantially reduces risk and increases loss control, our current prediction is for 19 very serious failures between 2018 and 2027."

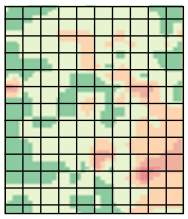
States World Mine Tailings Forum (Mining Technology, March 2019)

How It Works

1

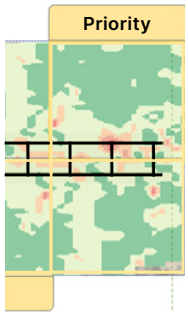
Customers provide ASTERRA with a GIS or KML map of their infrastructure. EarthWorks uses this as a base map layer over satellite optical imagery.

2



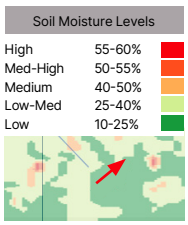
EarthWorks applies grid areas onto the base map.

3



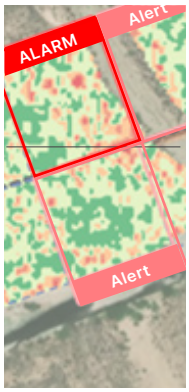
Working collaboratively with the customer, specific grids are assigned priority based on various circumstances (e.g., past slope failures, high traffic zones). These priority areas are highlighted on the base map, ensuring they receive focused attention during the analysis.

4



EarthWorks employs its advanced algorithm, accurately determining soil moisture levels and locations within each grid. The percentage of soil moisture within each grid is determined across 5 soil moisture levels from low to high.

5



EarthWorks' alert & alarm features provide a progressive notification system for soil moisture concerns. Alerts serve as early warnings, bringing the customer's attention to a grid where there appears to be a higher level of moisture within a specific soil moisture band. Alarms signify more severe situations, requiring immediate attention from customers to address potential risks.

6

Customers are advised to conduct an on-site investigation of the identified grid with elevated soil moisture to assess risks and promptly address issues.

About ASTERRA

ASTERRA (formerly Utilis) provides underground soil moisture data services on pipes, roads, rails, dams, levees, properties, and mines to water utilities, government agencies, and infrastructure managers. Using SAR (synthetic aperture radar) data from satellites and a series of proprietary algorithms, ASTERRA turns data into actionable intelligence that supports largescale decisions and Earth's resource resilience. Since 2017, in 64 countries, ASTERRA technology has saved over 315 billion gallons of water, 788,219 MWH of energy, and 201,784 metric tons of carbon. ASTERRA is headquartered in Israel with offices in the U.S., the U.K., and Japan.

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