

# DIRECTIONAL DRILLING SOLUTIONS

## HGB DRILLING IN POLAND



REI DRILLING, INC.  
DRILLING PRODUCTS, INC.

*DD-MET Project*



Wednesday, May 26, 2021



# Introduction and Background



**REI | DRILLING**  
DIRECTIONAL UNDERGROUND

- **REI “Resource Enterprises”**

- 40 Years Ago - Started by TerraTek, Inc. (now Schlumberger) to pursue commercialization of CBM in conjunction with both active mining operations, and un-mineable tracts.
- 1982 – 1992 Developed and Operated the first in-seam directional drilling CMM drainage and utilization project (pipeline injection) at the Soldier Canyon Mine near Price, Utah
- Aggressively canvassed domestic and foreign operating mines and coal basins for CMM/CBM project development opportunities
- 1998 – Current Controlling Shareholders of REI purchased mining related business units
- Aggressively expanded directional drilling services business to pursue geologic exploration, old works verification, and water drainage opportunities in coal mining and other mining sectors
- 2008 – DPI formed for development and sales of small diameter downhole directional drilling products
- 2012 – DPI releases the Geo-Steering System (DDMS), and sells over 40 units globally
- 2013-2016 Expanded directional drilling capabilities to include extended reach and borehole interception to provide innovative directional drilling solutions for methane drainage and water drainage and transfer
- **2018 – 2020 Focus on international coal opportunities - performed 2 Gob Gas Drainage Drilling Projects in Poland**



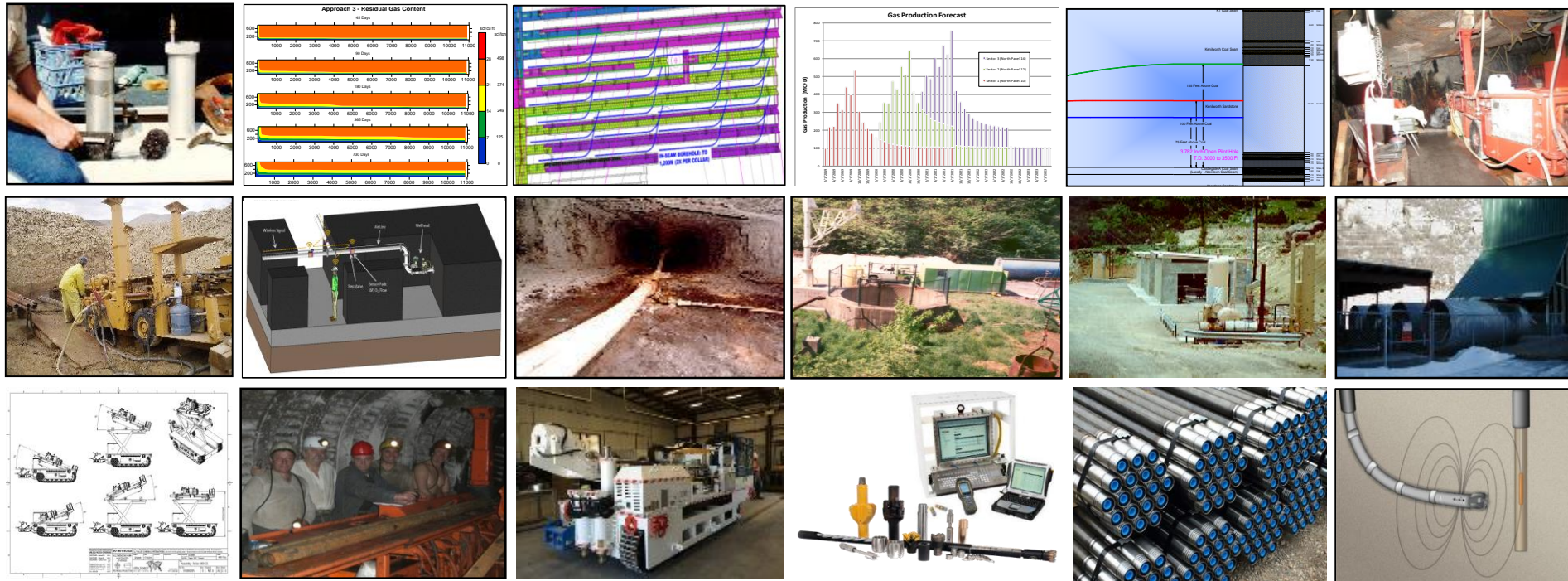


# Introduction and Background



**REI | DRILLING**  
DIRECTIONAL UNDERGROUND

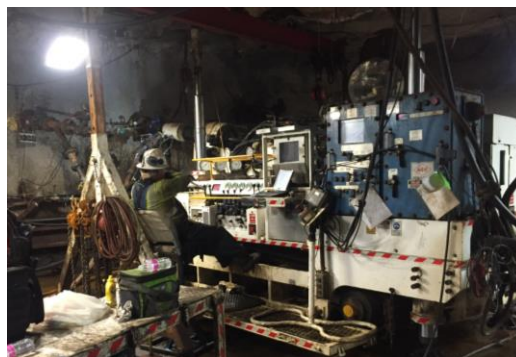
- Services, Project Development, and Products





# Directional Drilling

- **Drilling Equipment**

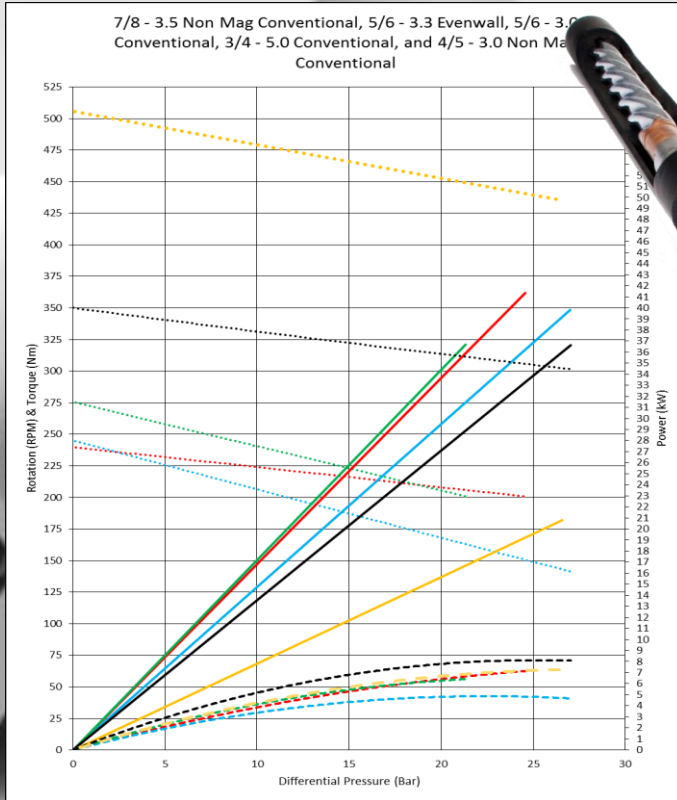


- **Drilling Equipment**
  - 6 MSHA Permissible Rigs
  - 1 Extended Reach MSHA Permissible Rig
  - 3 IECEx Track Rigs
  - 2 Core/Directional Rigs
- **Multi-Purpose**
  - Underground
  - Surface/Highwall
  - Mine Appropriate SIS
- **Applications**
  - Geologic Exploration
  - Old Works Exploration
  - Well Interception
  - Methane Drainage
  - Water Drainage/Transfer
  - Acid Mine Drainage/Blowout Prevention
  - De-Stressing
  - Utility/Monitoring
  - CMM Production
  - Underground Gravity Drainage of Oil
  - Surface Simulated Gravity Drainage of Oil
  - Solution Mining



# Directional Drilling

- Downhole Equipment





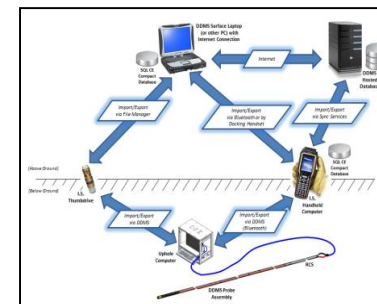
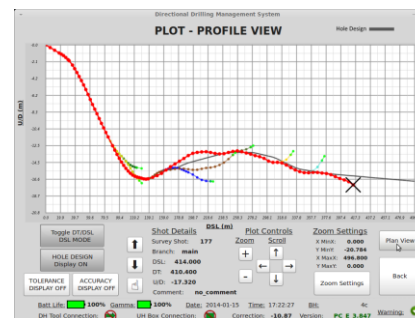
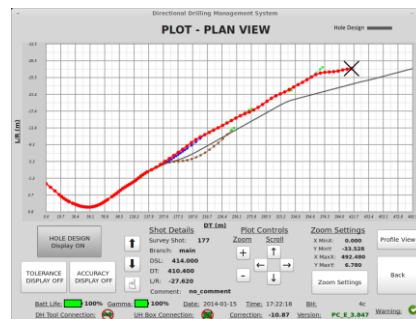
# Geo-Steering System

- DDMS

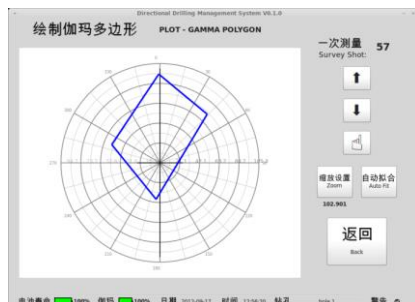
- On-Drill Navigation, MWD/LWD

- On-Board Drill to Plan

- Data Management



- On-Board Focused Gamma Polygon Guidance



- Roof

- Coal

- Floor



# Geo-Steering System



**REI DRILLING**  
DIRECTIONAL UNDERGROUND

## • Significant to REI's Success

General	
DDMS, Directional Drilling Management System consisting of an Uphole Computer, Down Hole Probe Assembly (DDMSPA) and permanently installed Rod Communication System (RCS) insert in each CHD or NRQ Series drill rod. Virtual management database access via DDMS Web Portal and Mobile Application. Forms Part of the Directional Drill System. Multiple Language Capacity (Mandarin/English) Display Capability.	

Dimensions			
Uphole Computer:		625 mm X 389.8 mm X 618.5 mm	
Weight:		145 kg (in mount) 45kg (out of mount)	
DDMSPA		Down Hole Unit (assembled)	
Length:	2204 mm	Length	2650 mm
OD:	50.8 mm	OD:	70 mm
ID:	44.7 mm	ID:	55 mm
Weight:	17 kg	Weight:	52 kg

Temperature Ranges DDMSPA	
Storage:	- 55 degrees C to 160 degrees C
Operation	0 degrees C to 75 degrees C
Uphole Computer:	0 degrees C to 45 degrees C

Downhole Battery	
Type	Non-rechargeable Lithium Thionyl Chloride
Expt. operational life	6,000 -7,000 Data Points
Model	DDMS-DH-0231
Voltage	18V
Capability	5.8 Ahr

Uphole Computer Features	
Computer specifications	AMD 1.6 GHz dual core, 4 Gbyte RAM and 64 Gbyte Solid State HDD with a Linux Operating System (supports Windows), Back Light LCD 17"
Display	17 Inch, Color LCD Screen, High Resolution 1,920 x 1,200 graphics.
Data Download Capacity	Portable Intrinsically Safe USB Thumb Drive with 4 Gbyte capacity. Bluetooth handheld PC with data management application, 512 MB capacity (can add more with SD drive).
DTP (Drill to Plan)	Real-time Continuous Toolface while drilling
Diagnostics	Downhole Hardware Diagnostics, RCS Signal Strength Analyzer

Survey Information		
On main data screen	Borehole name, shot number, Left-Right deviation, Up-down deviation, Azimuth, Pitch, Gamma, date, time, comment. Gamma polygon plot (up to 10 focused gamma shots per survey shot)	Shock and vibration vs. hole depth Up/Down deviation versus Downtrack Graph Left/Right deviation versus Downtrack Graph Graphical Toolface indicator
Data download file	Hole, Shot, Branch, DSL, Pitch, Inclination, Azimuth, Dip, TLF, LR, UD, DT, DT, Mag_field, Gravity, Voltage, Temp, time, date, comment, gamma data	Descriptive information about borehole: calibration, desired heading, sensor serial numbers, mine name, location name, borehole comments
DDMS Data Management	Access to a virtual management database via Web Portal, remote data management. View PDF documents and user manuals on the Uphole Computer. Update planned hole design remotely.	Add voice, photo, and text clips as comments to a survey shot and upload to Web Portal. View borehole plots and gamma polygon plots on Handheld Computer.

Shock Tested Capacity		
Directional Sensor	1000 G 1ms half sine wave	20 G rms 5-1000 Hz
Gamma Sensor	1000 G 1ms half sine wave	10 G rms 50-250 Hz
Uphole Computer	Internal and external shock mounted. Passed impact testing on glass window.	

Certification	
Uphole Computer	Ex I M2 (M1) Ex d [ia op is Ma] I Mb [IP40]
Handheld Computer	Ex I M1 /II 1GD Ex ia I/IIC T4
Keyboard	Ex I M2 Ex ia I Mb
USB Thumb Drive	Ex I M2 Ex ib I Mb
Probe Assembly	Ex d [ia] I/IIA Gb Mb IP68

Uphole Computer	
Type:	Mains operated
Input Voltage:	90 – 250 V AC
Accuracy	
Direction Sensor	
Inclination	± 0.1 degrees
Azimuth:	± 0.3 degrees

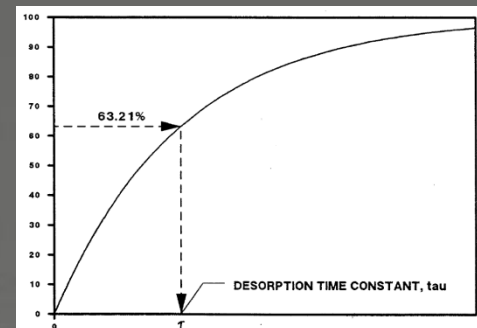
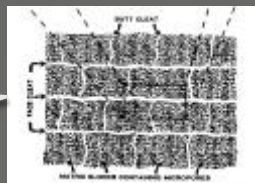
- Increases directional drilling productivity
- Improves anomaly characterization
- Improve adjacent strata navigation
- Provides for unique correlations



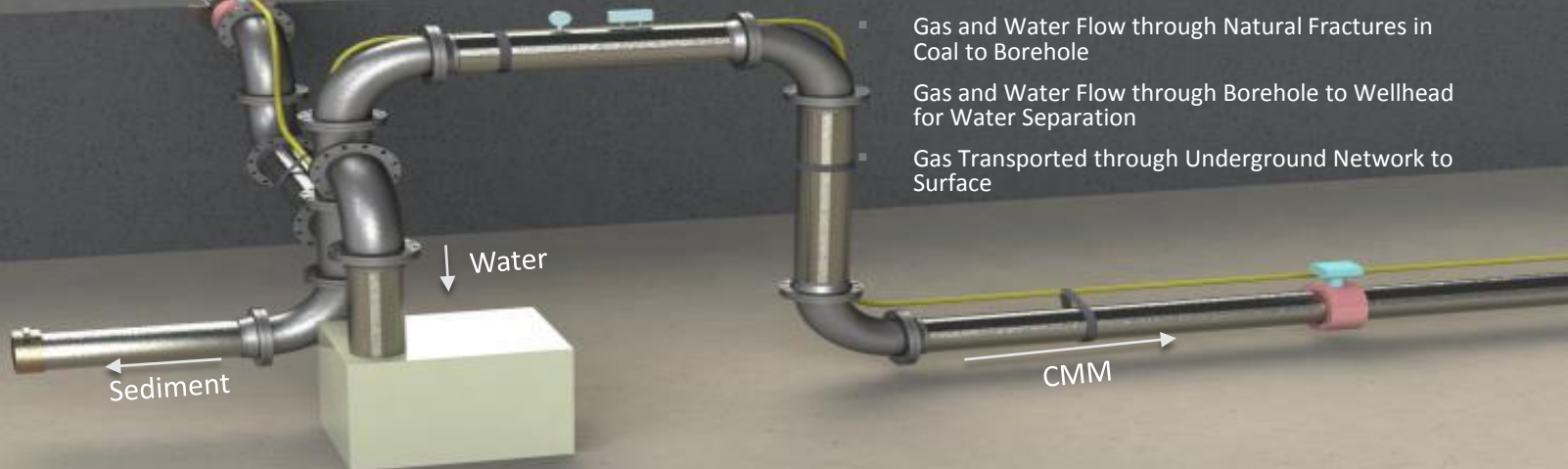
# Geo-Steering with the DDMS

## ■ In-Seam Drainage

> 600 m<sup>2</sup> of  
surface area for  
2,000 m borehole



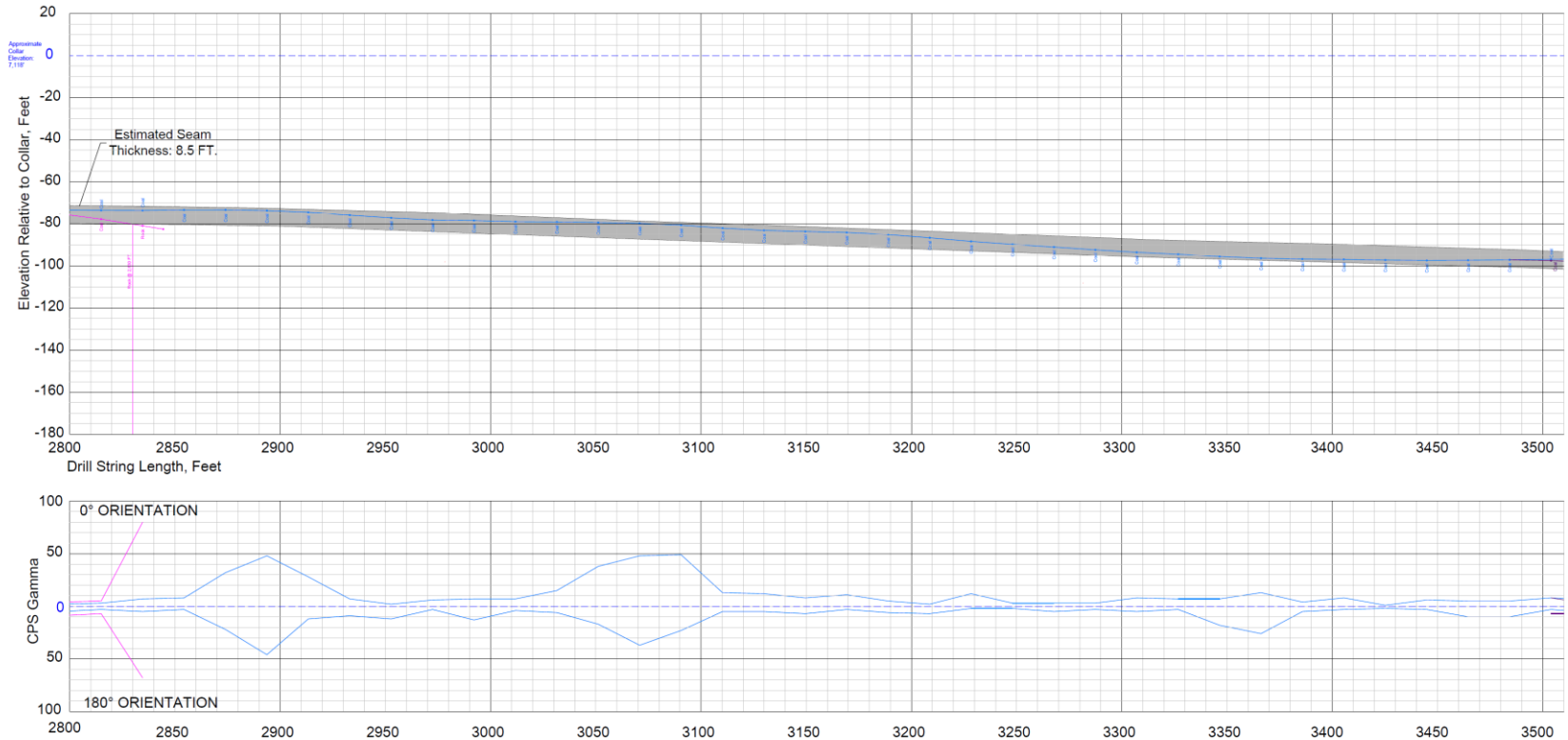
- Pressure Gradient Driven Flow
  - Gas Desorption from Microscopic Coal Surfaces
  - Gas and Water Flow through Natural Fractures in Coal to Borehole
  - Gas and Water Flow through Borehole to Wellhead for Water Separation
  - Gas Transported through Underground Network to Surface





# Geo-Steering with the DDMS

## ■ In-Seam Navigation





# Geo-Steering with the DDMS

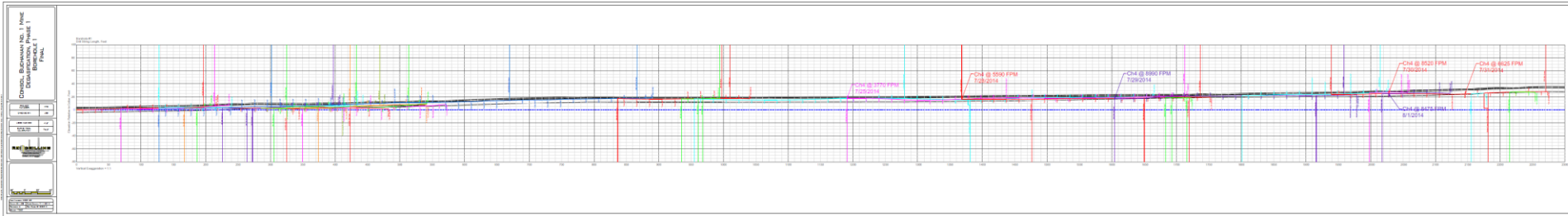


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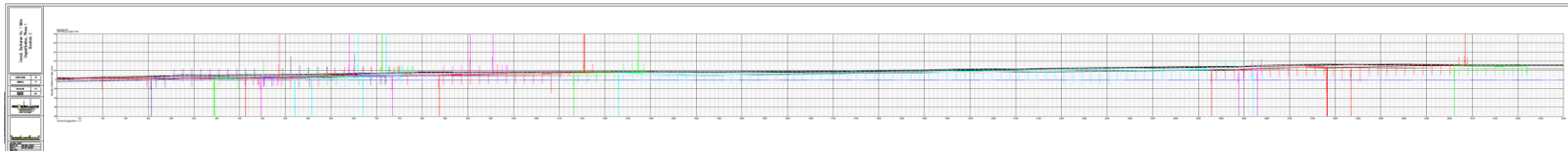
- Increases Drilling Productivity

- 1.5 m Coal Seam with Friable Coal/Shale Upper Layer, Sandstone/Clay Floor:

- Borehole No. 1 – 695 m, 22 side-tracks, 1 side-track / 35 m average, not using Gamma 0/180



- Borehole No. 2 – 981 m, 14 side-tracks, 1 side-track / 70 m average, with Gamma 0/180



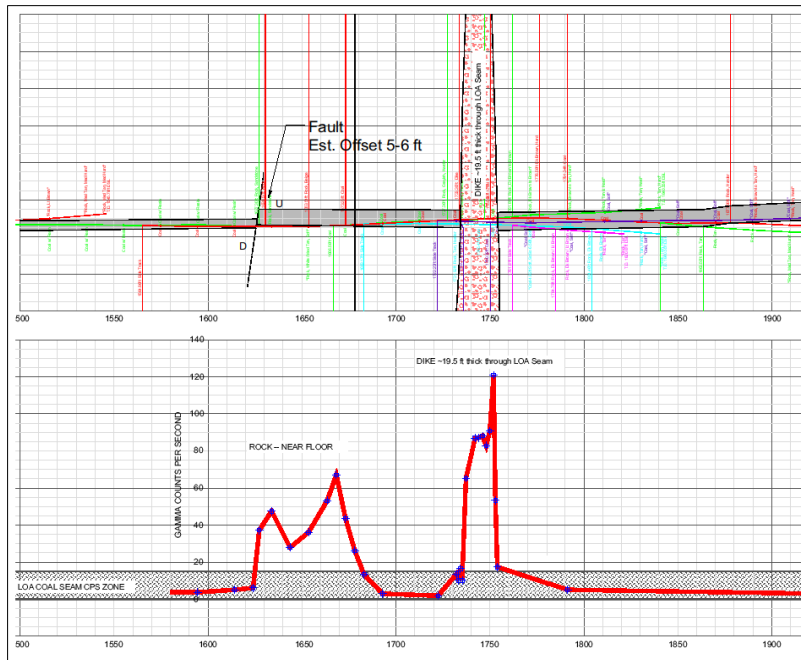
- Side-track drilling meters reduced by 50 percent, productivity increased by 30 percent



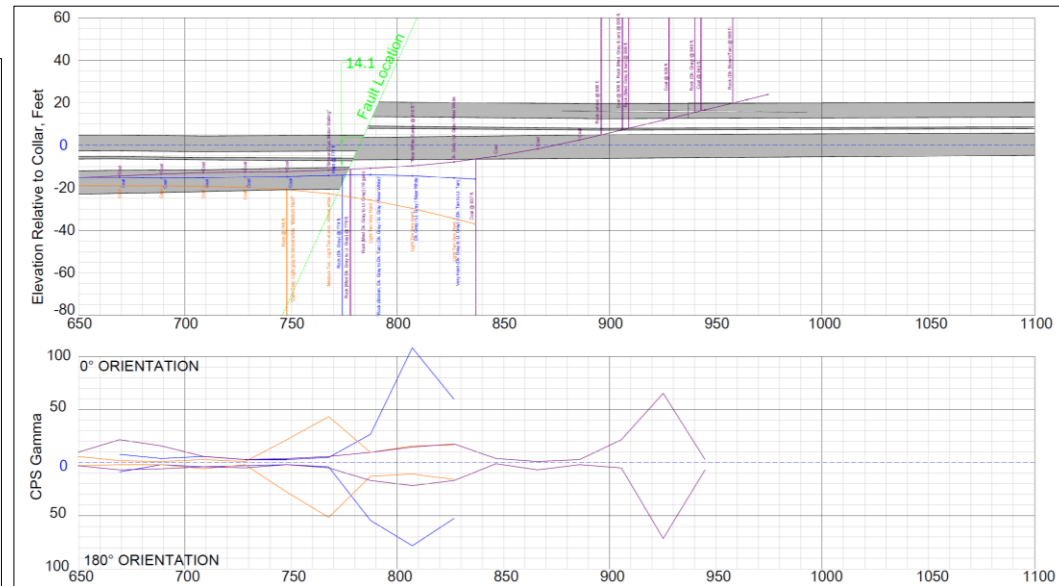
# Geo-Steering with the DDMS

- Improves Characterization Capability

- Characterization of Geologic Intrusions



- Characterization of Faults / Adjacent Seams



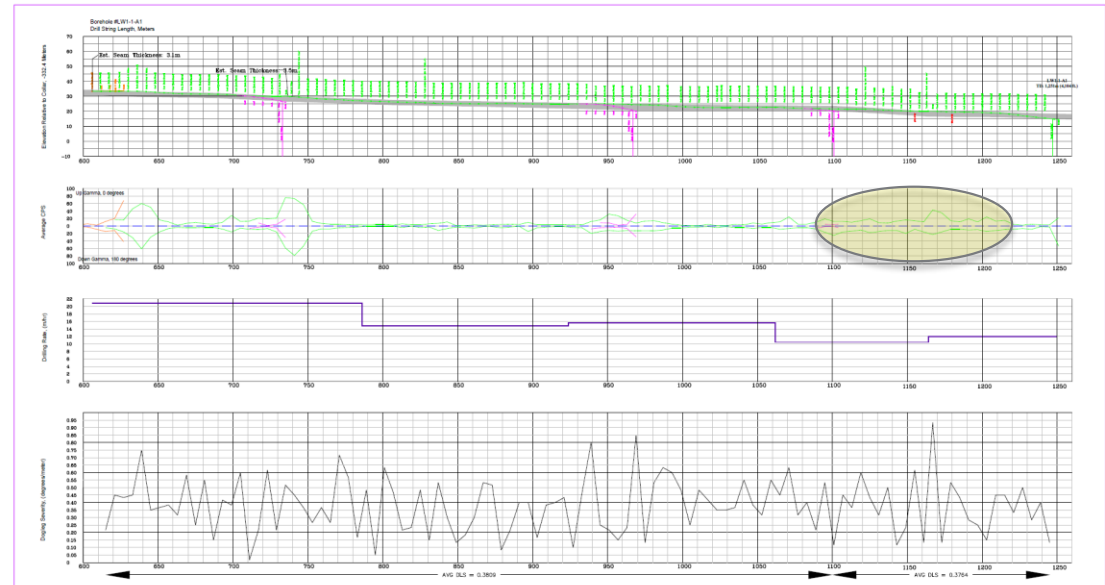
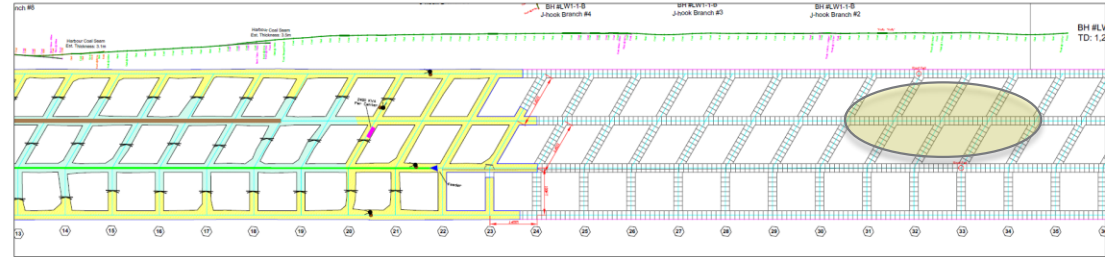
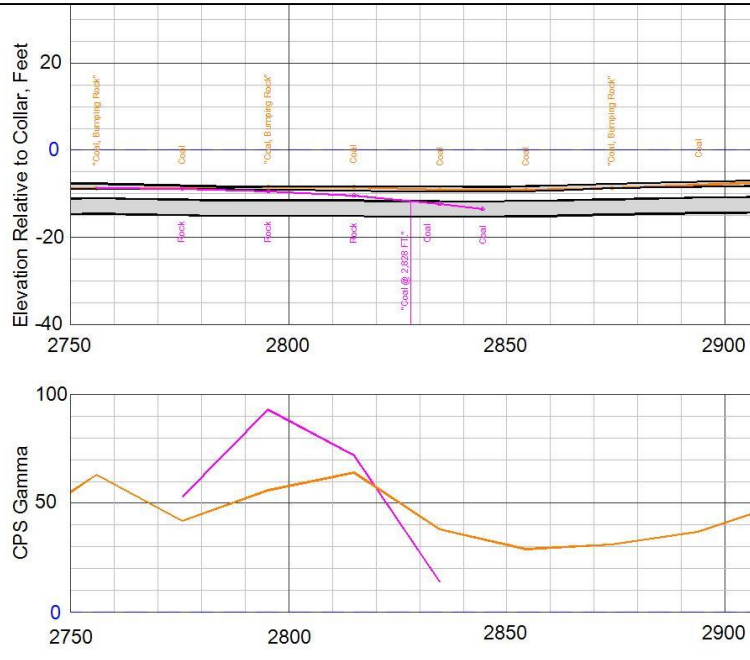


# Geo-Steering with the DDMS

- Provides for Unique Correlations

- Identifying Stressed Coal Zones

- Differentiating between Coal Seams

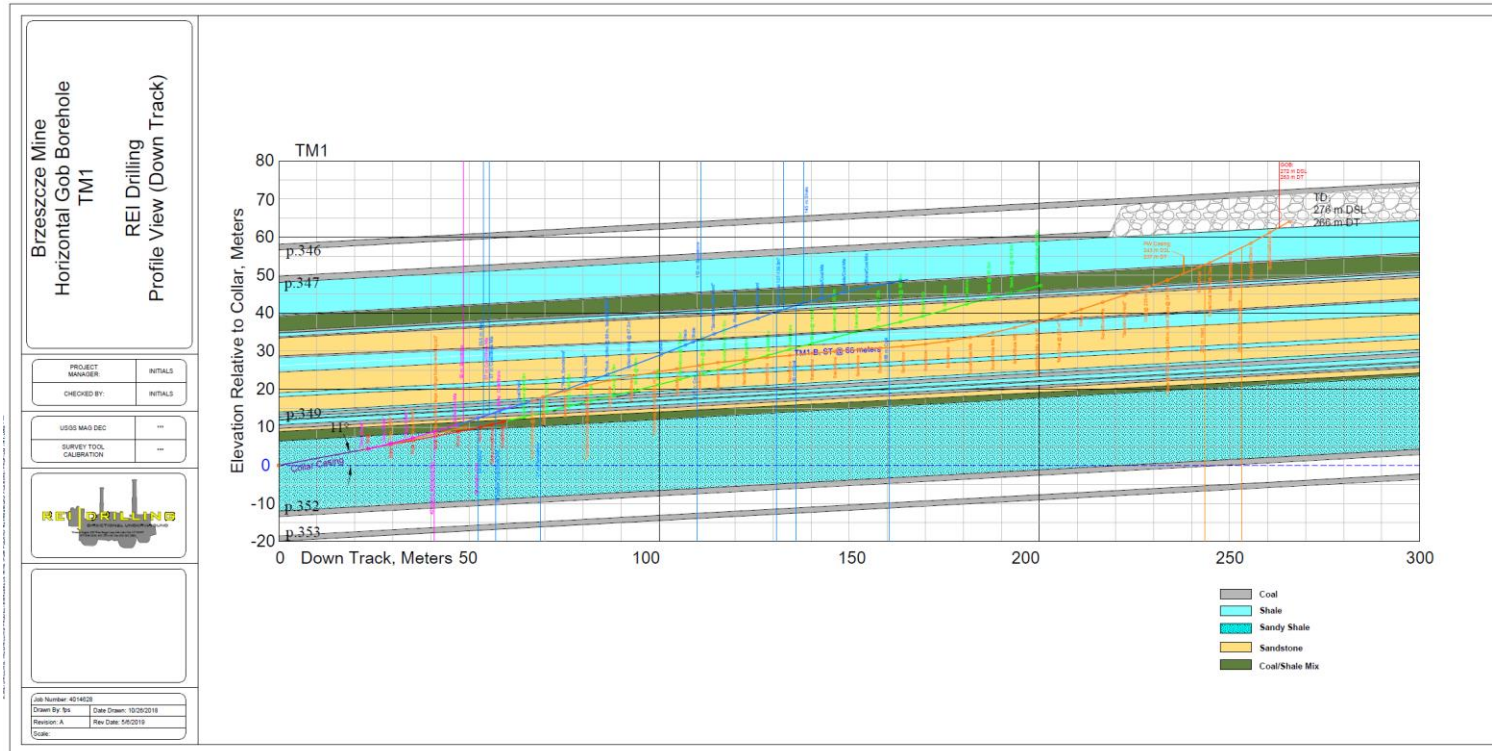




# Horizontal Gob Borehole Applications

## ■ Brzeszcze Mine

### ■ Underlying Approach to Post Mining Gob Gas Production



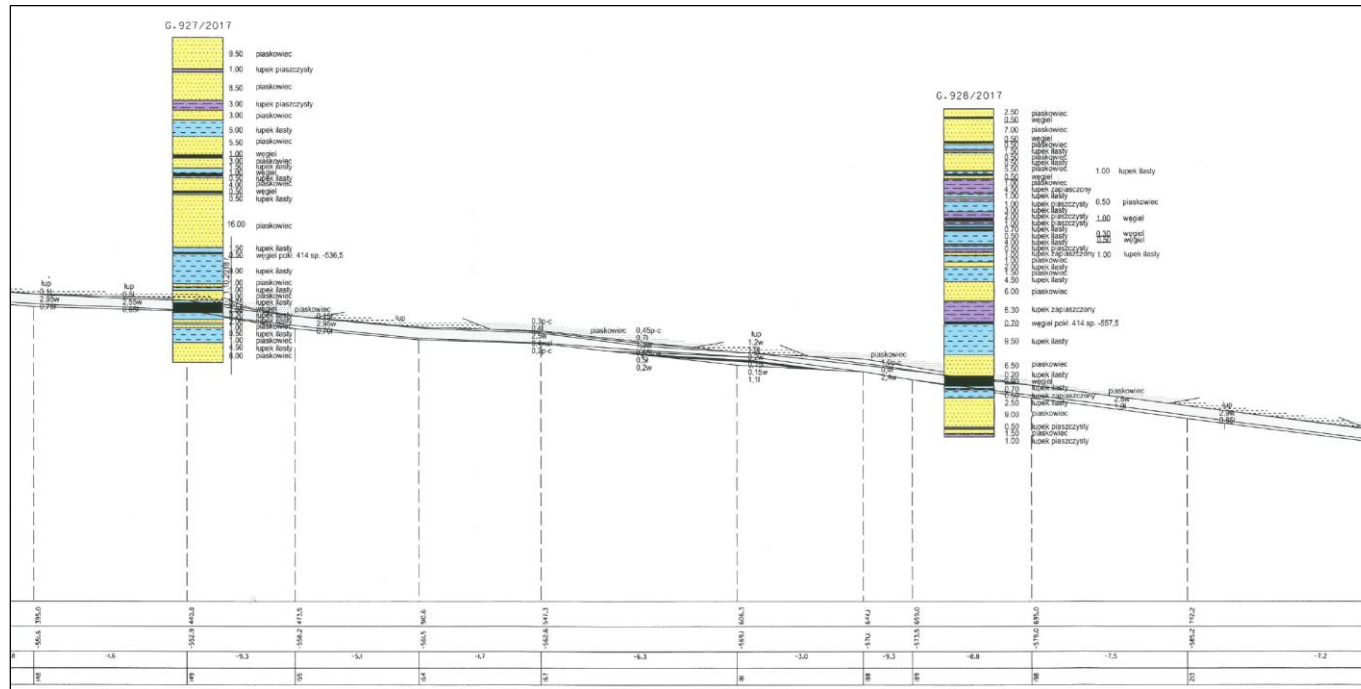
- Directional drilling through overlying strata in the Upper Silesian Coal Basin
- Borehole stability through Shales, Coals, Coal/Shale Mix
- High angle directional drilling strategy
- Identification of drillable strata for lateral directional drilling
- Use of Geo-Steering to safely steer in drillable strata



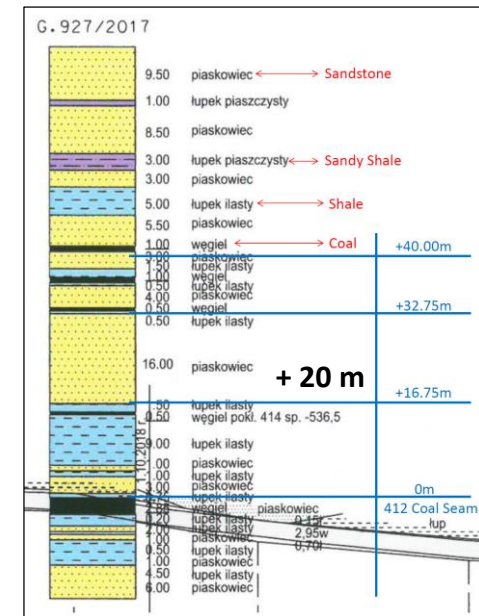
# Horizontal Gob Borehole Applications

## Wesola Mine

### 413a Tailgate of Panel 412



### Target Elevation above 412 Coal

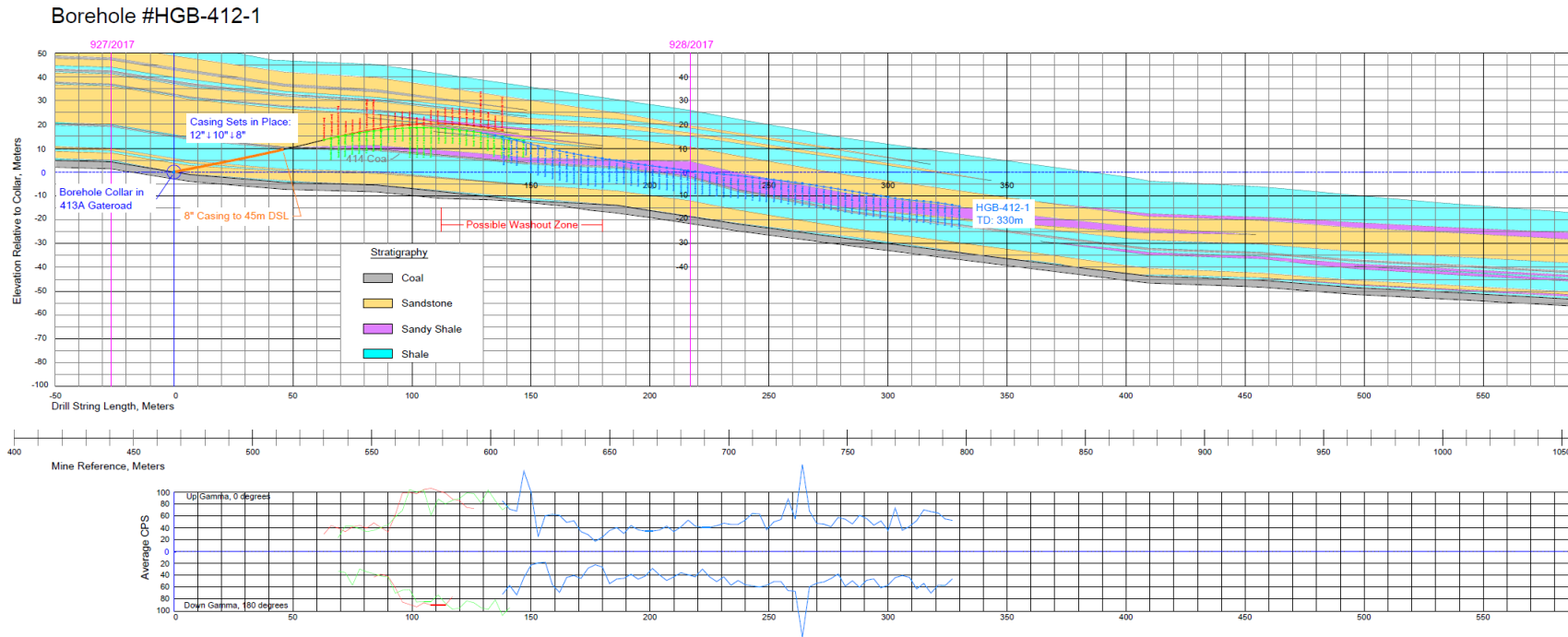




# Horizontal Gob Borehole Applications

## Wesola Mine

### HGB 412-1 Cross-Section

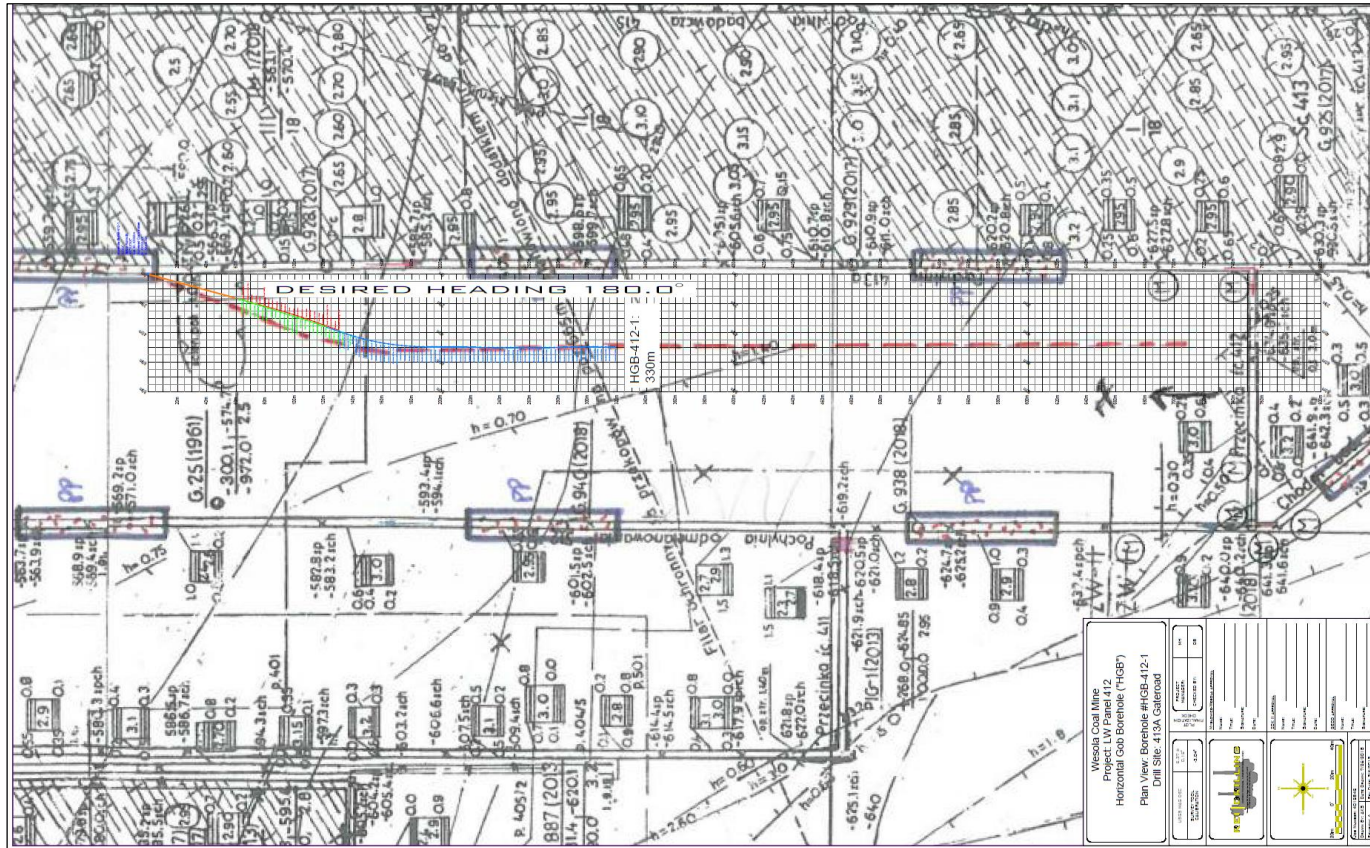




# Horizontal Gob Borehole Applications

## ■ Wesola Mine

### ■ HGB 412-1 Plan View



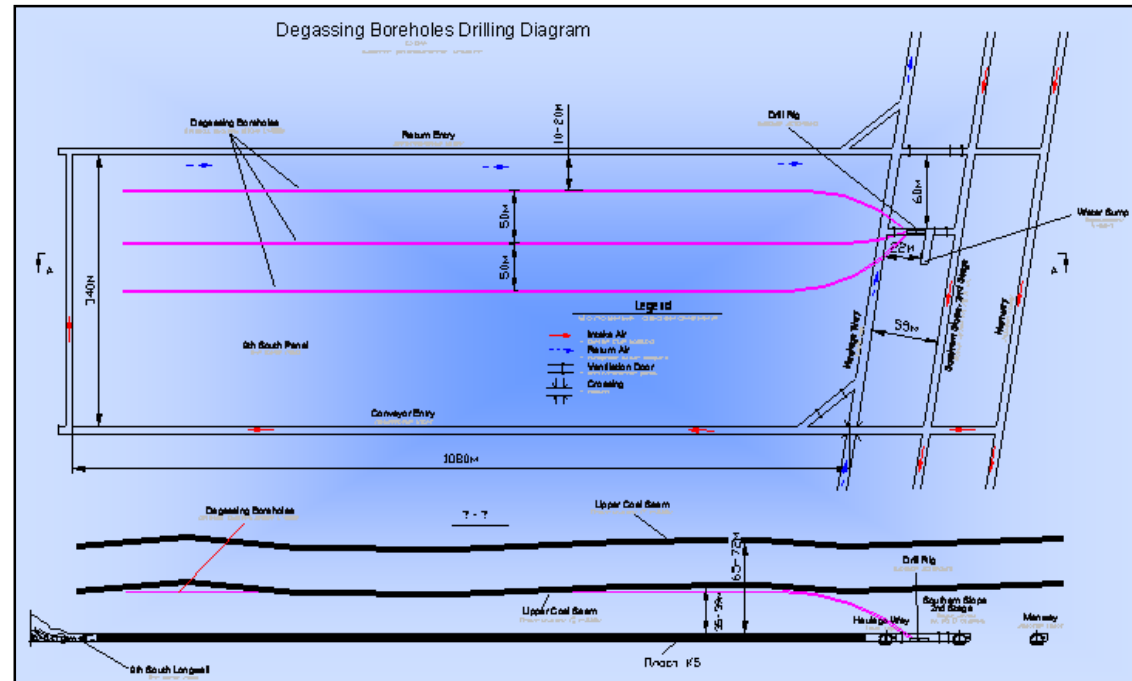
+ 60 m



# Service Offerings

## ■ Complete Directional Drilling Solutions

- Provide Complete Solution from Design to Implementation
- Specify Custom Drill Configurations Specific for Project
- Design with Alternative Drill Equipment Manufacturers
- Supply Complete Customized System
- Implement and Demonstrate Effectiveness
- Training and Support, Technical and Equipment



- Implementation of HGB's in the Ukraine
- Directional Drilling Training

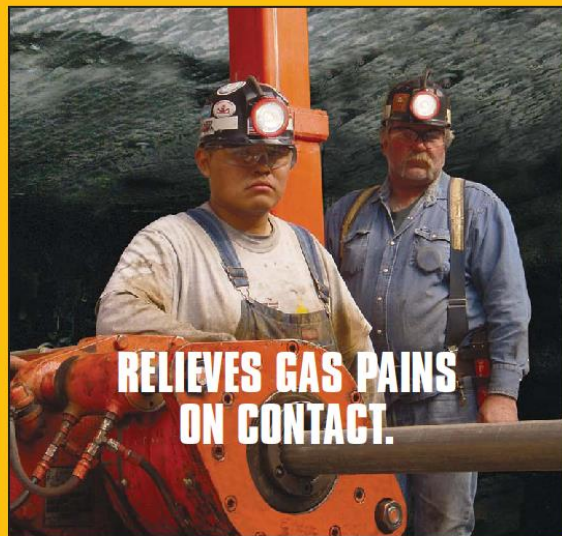


# Your Consideration is Appreciated



**REI | DRILLING**  
DIRECTIONAL UNDERGROUND

## ■ 40 Years of Experience



High methane emissions are enough to upset anyone's stomach—as well as potentially proving disastrous for mining operations. That's why so many mine operators call on REI for downhole directional drilling before mining operations advance. Because we are able to accurately steer and place boreholes in excess of 5,000 ft in length (depending on conditions) we can explore, discover and reduce the gas content of the mining or adjacent seams. Which creates greater productivity and safer mining conditions.

REI's expertise and fleet of seven state-of-the-art directional drills allow us to accurately steer and place boreholes even through unpredictable coal seams. In many cases, the gas from these in-seam boreholes can be collected and sold in commercial markets. And that can prove significant given the rising



value of and projected future demand for natural gas.

Put REI's proven world-wide expertise to work for you today, and have peace of mind about your next mining plans. REI can also assist you with exploration for old workings, geologic exploration, and de-watering, from surface or underground.

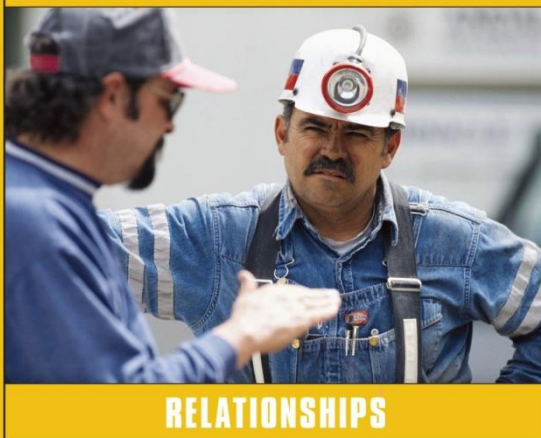
So if the thought of high methane emissions gives you a sick feeling, call REI today. After all, we're the company that can relieve your gas pains on contact.

**REI Western Region**  
45 East 4500 South, Suite 300  
Salt Lake City, UT USA 84107  
Tel: (801) 270-2141  
Fax: (801) 281-2880

**REI Eastern Region**  
2519 White Hall Road  
Crozet, VA USA 22932  
Tel: (434) 823-2085  
Fax: (434) 823-2087

**REI Drilling**  
The source for your  
directional drilling needs  
toll-free (877) 838-0534 [www.reidrilling.com](http://www.reidrilling.com)

**ALTHOUGH WE'RE A DIRECTIONAL DRILLING CONTRACTOR  
MOST MINES KNOW US FOR WHAT WE BUILD:**



**Building relationships takes time.** It also takes reliability, consistency and integrity. In fact, a great relationship is really just a great partnership.

That's why, at REI, we pride ourselves on all the great relationships we've developed over the years. Because what matters to our clients really matters to us. We genuinely care what you think about our service and skills. So we would rather not make money than do a poor job. And that's the way we've been doing business for the past 25 years. REI works shoulder-to-shoulder

solving problems with clients. And the result is a level of trust that is critical to building sound relationships.

REI works with mining operators on drilling projects from concept to completion, often dealing with difficult, complex geologic or mining conditions that require solutions rather than excuses. We won't walk off the job and stick you with an invoice. We are far more than a directional drilling contractor. We provide innovation, perseverance, and a "can do" attitude. After all, our roots are in coal mining.

So if it's exploration of old workings, geologic anomalies, or gas/water drainage, REI will formulate a cost effective, results oriented drilling approach (from underground or from the surface) and provide the work at a fair price. Our fleet of seven directional drilling units are matched for each application whether it is in coal or rock. And we can drill in excess of 5,000 ft.

**If that is the kind of relationship you want, call REI today.**

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**So it shouldn't surprise anyone** that in October we drilled an in-seam directional borehole to a record depth of 5,325 feet at the Buchanan Mine in Virginia. You see, we take our charge to "go the extra mile" seriously. In fact this was one of five in-seam boreholes that REI drilled to depths of greater than 5,000 ft.

REI also goes the distance to build working relationships. We don't just drill boreholes. At REI we take the

time to do the job right. Which often means going out of our way to find the answers to complicated problems whenever and wherever they occur, be they in planning or during drilling.

Our fleet of seven directional drilling units—each unique in both physical dimension and capacity—are matched to the exacting demands of each application. This, combined with the expertise of our team of seasoned engineers and geologists, assures creative and practical

drilling solutions to the myriad of mining problems or clients encounter.

From exploration for old workings, geologic anomalies, or reducing gas content, draining gob gas, or transferring or draining water, REI offers a cost effective, results-oriented drilling approach at a fair price. For more information please call or e-mail us today.

**And see how we'll go the extra mile for you, too.**

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