

Subsidence above abandoned underground coal mines, Deep Run Mining District, Henrico County, Virginia.

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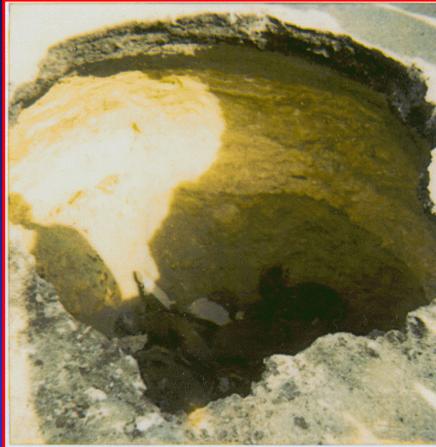
Air photo of site. Yellow dot marks site of 1998 failure. Green dashed line marks location of abandoned coal railroad track bed.



Looking East into the Deep Run Triassic Basin along U.S. Route 250, West Broad Street. Yellow arrow marks approximate failure location.

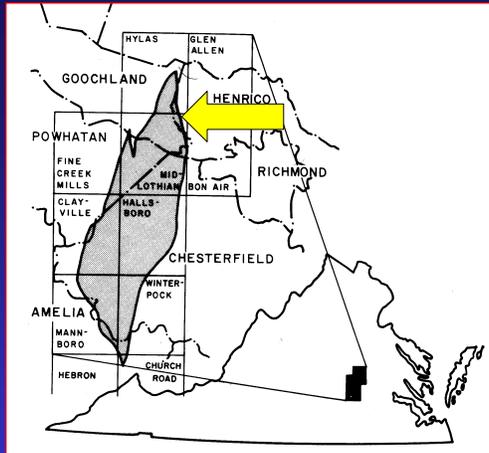


Original failure was in travel lane adjacent to depressed area of curb and gutter, approximately where the red SUV is parked. This area contains abundant underground fiber optic, natural gas, water, sewer, telephone, and electric services.

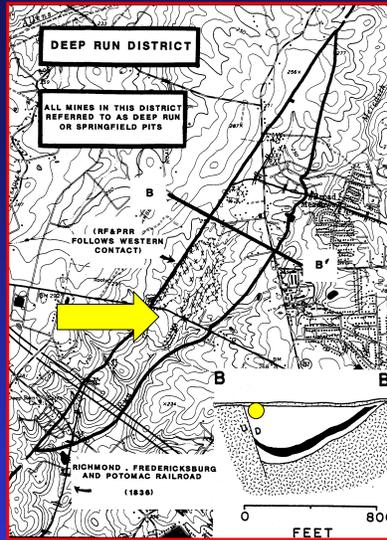


250 E.B AT DEEP ROCK
COLLAPSED MINE SHAFT
12' LX 8' WX 30' deep

Polaroid photo of shaft
exposed upon removal of
the overlying asphalt
pavement.



Shaded area represents
Richmond Triassic Basin,
yellow arrow marks
approximate project site.



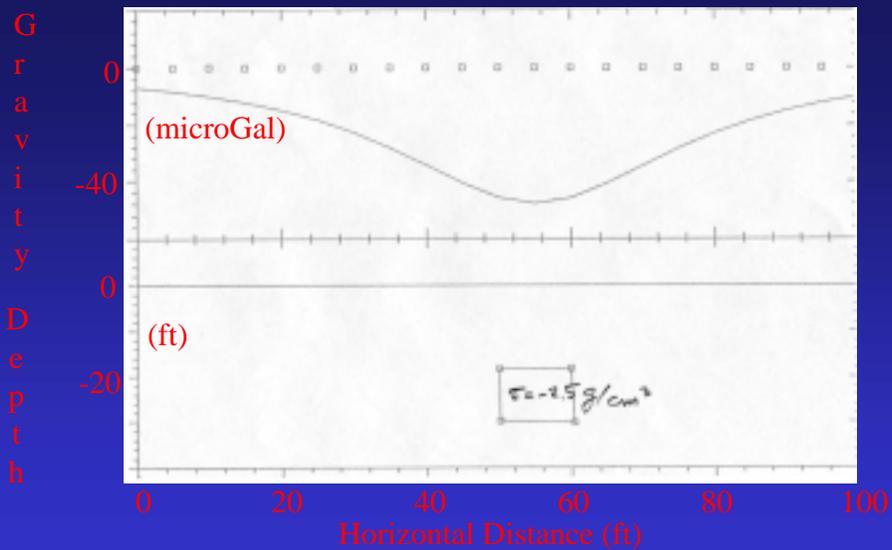
Detail of Deep Run District. Note coal shown in cross section. Yellow arrow and dot mark project location in map and cross section views respectively.



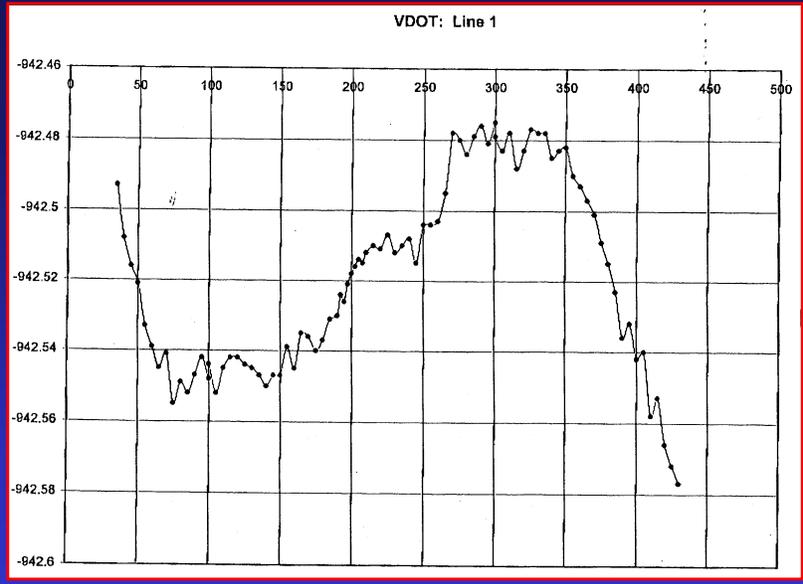
Mining the Richmond Basin *ca.* 1935.



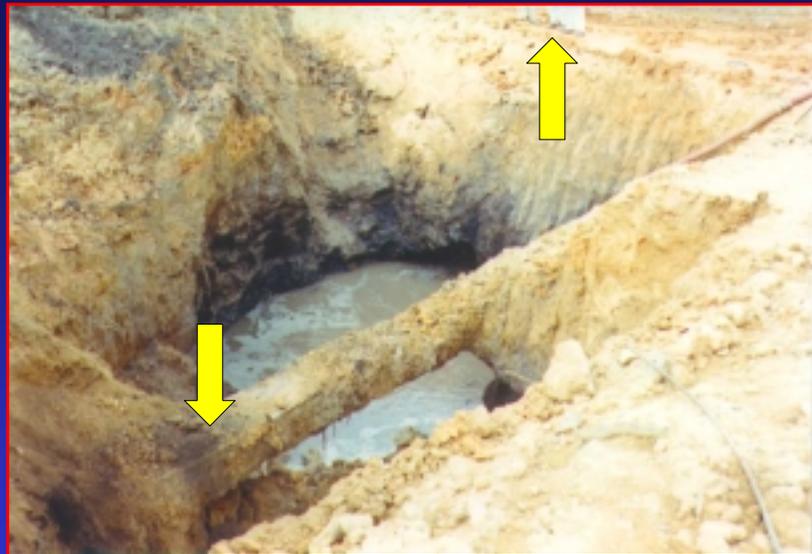
The morning after the initial collapse and repair. Note choice of positions, engineers and administrators above repaired shaft, geologists and drillers safely off to one side.



Computer model of anticipated gravity results for a 10 ft by 10 ft void between 20 and 30 foot depth.



Printout of actual microgravity measurements.
Individual low points were drilled to verify presence of voids without success.



Mine workings encountered during original construction before dewatering. Note large support beam and feet at top of photo for scale.



Mine workings excavated during original construction before attempted dewatering. The aggregate backfill placed during construction was not encountered during our investigation.



Attempted dewatering of the mine in progress. Total track hoe boom length is approximately 20 feet.



Mine workings after partial dewatering. Complete dewatering was not achieved due to rapid refill rate.



Night drilling on 10 foot centers. Adequate lighting to log accurately was a problem especially when operating multiple rigs.

Fabriform systems

Fabriform pile jackets

Zippered fabric forms for marine pile repair

Fabriform Pile Jackets are a strong lightweight concrete form used in marine pile rehabilitation. Jackets are custom assembled to project requirements to fit any length and size of steel, timber or concrete piles.

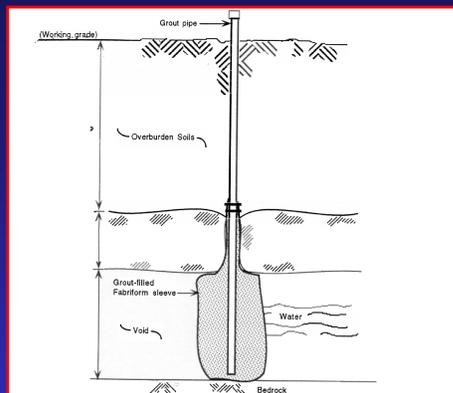
Pile jackets lower production costs.

1. Preassembled, no form fabrication required.
2. Easy to handle, requires no lifting equipment.
3. Forms bleed excess mixing water. A lower water/cement ratio provides exceptional concrete durability.
4. No honeycombs/voids.




Fabriform

The system adapted for this application.



TYPICAL GROUT HOLE ELEVATION

<p>TECHNICAL FOUNDATIONS INCORPORATED</p> 	<p>GROUT HOLE DETAILS</p>	<p>SCALE: N T S BY: LHA DATE: 02/17/99</p>
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Typical grout bag
installation details.



Typical bag installation procedure. One bag being filled, the next boring being drilled, and the next bag fastened to grout pipe with rubber bands ready to install.



Raising grout bag into position.



Lowering the bag into the boring.



Driller drawing standby at the rate of \$250.00 per hour while the grout bag is positioned.



Grout mixing tanks, grout pump, and sand stock pile.



Monitoring grout volume and pressures.



Each grout location was painted with a white circle and air photos were taken to record locations. We did not survey in order to prevent traffic disruptions.



Slight dimples in the Superpave asphalt overlay due to subsidence above the grout pipes that were left in place after installation of the grout bags.



This shaft opened up in the fall of 2000. It is just beyond our Right of way outside the area repaired.



This “small” shaft opened up in a private driveway just beyond our Right of Way on a nearby road.



Down hole close up.



Shaft was originally backfilled with organic debris, settled approximately 5 feet in depth only 8 feet from garage door.